American Machinist

Volume 64 New York, June 24, 1926 Number 25

Reducing Lost Time Accidents

By Sanford DeHart

Director of Hospital and Employment Depts.
The R. K. LeBlond Machine Tool Co.

Studying shop accidents in detail—Slight effort reduces number and severity of accidents—Best methods of prevention—Practical results in time and monetary savings

DURING the past ten years we have made an assiduous study to ascertain the causes of serious accidents in the machine shop, what injuries cause the greatest loss of time, and what remedies may be applied. That we have succeeded is illustrated by our accident statistics, which show that each year our lost time due to injuries incurred in the shop has been reduced.

The records of the Le Blond plant show that by far the greatest loss of time is due to strains from improper lifting. Falls suffered by the workman, or the dropping of objects on the feet and legs, are the next important causes of loss of time. The fingers are the most exposed part of the anatomy of the machine operator, and are more often injured slightly, while the legs and feet are most frequently seriously injured by falling objects. The abdominal and back muscles are the most vulnerable to strains and ruptures. It seems that some feet are positively magnetic when it comes to attracting heavy objects to them, and some backs and abdominal muscles were never designed by nature for the machine shop. In Fig. 1 is illustrated a common cause of injury to the hand, and in Fig. 3 is shown a dangerous position of the hand. Workmen should be taught to keep their hands on the outside of all movable parts.

By actual demonstration we have found that practically all these accidents can be prevented, or at least

Fig. 1—Dangerous method of tightening nut. Fig. 2—The right method

Fig. 3—Endangering the hand

minimized, with little effort. When it was shown that many of our lost-time accidents were due to the fact that the worker had not been properly instructed in the proper way to lift, and when it was demonstrated to him how to avoid throwing any unusual stress on the abdominal or back muscles, our lost-time accidents began to decrease. In Fig. 5 and Fig. 6 are shown the proper and improper methods of lifting. The procedure in preventing these injuries is so simple that it takes only a few minutes of the foreman's time to teach the worker how to avoid them.

One great trouble with many sprains and strains is that they are controversial, and every effort should be made to avoid injuries of this class for that reason, if for no other. This statement will be better understood when it is known that many cases of lumbago will stimulate a severe strain. Of course, lumbago is not compensable, since it is not an occupational condition. Often it is rather a difficult matter to convince a worker that lumbago is not a strain, in view of the fact that many times it occurs while the worker is lifting; or a latent case of lumbago may be aggravated by slipping on the floor.

Hernia sprains probably cause the most annoying conditions that industrial physicians and state compensation boards have to meet. In looking over the accident reports of one state, I find that there has been an average of two cases a week for arbitration where the employer and employee could not agree as to the contributory factor in settling the cause of hernia. When a case of this kind comes up the worker is often inclined to think that he has received a "raw deal," and he conveys this information to his fellow workers. A disgruntled worker of this kind does not make a desirable ingredient for good morale in the plant. Industrial managers should realize this, and make every effort to prevent injuries, not only for humane and economic reasons, but for controversial reasons as well.

Accident statistics prepared by the Industrial Commission of Ohio for the month of January, 1926, show that 15 workmen were killed; two while handling objects, one by hand truck, three by strains, and 9 by falls or by falling objects. As each one of these accidents may cost the maximum death award of $6,500 and contingent expenses, the value of instructing the worker in the prevention of these injuries is readily seen.

Many of the accidents due to falling are caused by oily floors, and can be prevented by good housekeeping; that is, by keeping floors free from oil, or mopping the floor with a solution of sal soda, where dripping cannot be prevented. Falling from ladders is another source of casualties, and can be prevented by equipping ladders with safety shoes to prevent slipping, and replacing all missing rungs. Worn stairs or treads, or broken nosings on stairs also present a great hazard. Other causes of falls are oil and grease on stairs, loose treads, and poor lighting of stairs.

Crowded aisles cause many serious accidents that could be prevented by laying out safety aisles. The internal transportation of material affords a serious hazard, and each truck that travels the aisles should be equipped with a horn or bell to warn of its approach.

A study over a period of ten years showed that a large loss of time came from eye accidents, and by careful attention these have been reduced about 70 per cent. In one machine shop 60 per cent of the men reporting to the hospital were suffering from foreign matter in their eyes, and fully 80 per cent of the eye accidents occurred in the grinding and polishing departments. In one year the safety men of this plant were able to reduce the eye injuries 40 per cent.

In addition to suitable goggles being furnished to the worker, the hazard is greatly reduced by placing a glass shield over the wheel. Grinding wheels should be provided with a guard to withstand the shock of a bursting wheel. The guard should be adjusted close to the wheel, and extend over the top of the wheel at least thirty degrees from the vertical. Grinding wheels should also be equipped with safety flanges. An idea may be gained of the hazard present in grinding wheels when it is known that in actual practice wheels are run

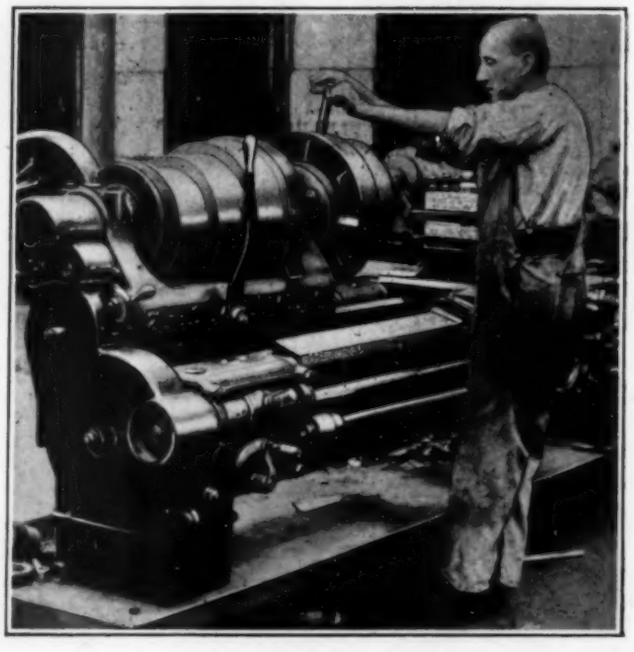


Fig. 4—A bad bracing position

Fig. 5—A cause of strained backs

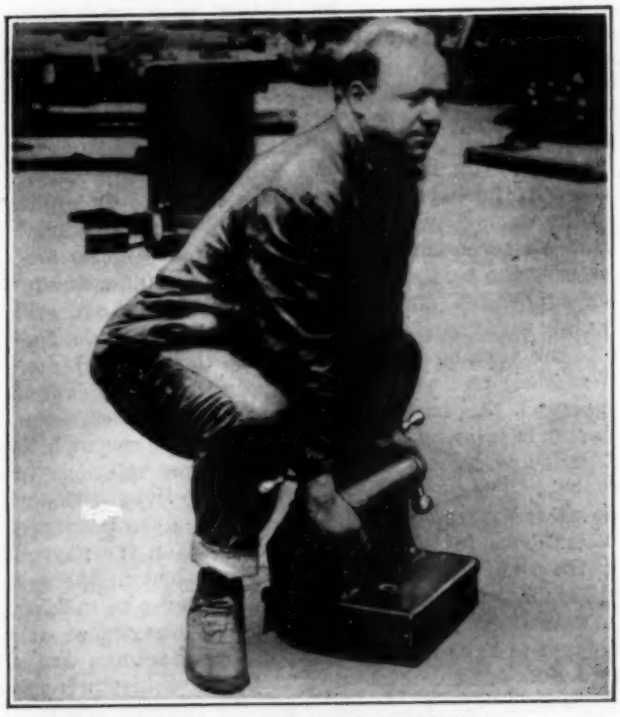


Fig. 6—Correct method of lifting

at a surface speed of from 4,000 to 6,000 ft. per min. up to as high as 7,000 ft. per minute.

Variable speed countershafts, pulleys, or motors will do much to reduce the grinding wheel hazards. The cup form of wheel, owing to its shape, is considerably weaker than the straight wheel of the same weight, and should be operated at a speed of probably not over 4,500 peripheral feet per minute. As a grinding wheel wears down the speed is increased to maintain the same surface speed, and for this reason attention should be given that a newly installed wheel is not overspeeding.

A report of the hospital activities of the LeBlond plant for the year 1925 shows that there were 300 less hours lost from shop injuries during the year 1925 than during 1924. The amount of compensation paid for shop injuries amounted to only $329 for the year, showing a real return from the safety work. Benefiting by its scheme of accident prevention the company carries its own insurance.

The results in time saving to both workman and shop by an accident prevention program is seen in the fact that in the LeBlond plant during the year 1915, there were 560 days lost because of accidents, and this number has been annually reduced until a low record of 151 days lost time was reached for the year 1925. Out of a total of 837,773 working man-hours only 1,364 man-hours were lost in the year, or considerably less than one-fifth of one per cent. Reducing this to working days it means that an average only about ½ of a day per workman was lost during the entire year from all classes of injuries even those normally considered slight and of frequent occurrence. Our experience, therefore, has convinced us that most lost time accidents can be prevented by proper instruction.

The Relation of Load to Wear on Gear Teeth—Discussion

BY EARLE BUCKINGHAM

Some errors in my paper on the above subject, published on page 777, Vol. 64, of the *American Machinist*, have been pointed out to me by J. Pesqueira, Philadelphia, Pa. In solving for W the first equation should have read

$$W = \frac{\frac{1}{4} S^2 F \left(\frac{1}{E_1} + \frac{1}{E_2}\right)}{\frac{0.35}{\sin A}\left(\frac{2}{D_1} + \frac{2}{D_2}\right)} = \frac{S^2 F \sin A \left(\frac{1}{E_1} + \frac{1}{E_2}\right)\left[\frac{D_1 D_2}{2(D_1 + D_2)}\right]}{0.35}$$

Then K = stress factor $= \frac{S^2}{4 \times 0.35}\left(\frac{1}{E_1} + \frac{1}{E_2}\right)$

and Q = ratio factor $= \frac{2D_2}{D_1 + D_2}$

as originally given.

The final value of K is

$$K = \frac{S^2 \sin 14\frac{1}{2}^\circ}{4 \times 0.35}\left(\frac{1}{E_1} + \frac{1}{E_2}\right)$$

and this is the value given in the tables.

In using the Hertz equations, my object was to introduce a ratio factor. This factor, it seemed to me, would be most convenient if it were equal to unity for equal pairs. This selection would also make the K-factor as determined by the Hertz equation, comparable with similar factors now in use.

Also, for purposes of simplification, it seemed advisable to use a constant pressure angle of 14½ deg. Otherwise it would be necessary to use the normal tooth pressure instead of the tangential pressure, a procedure that would introduce a refinement in the calculation that would not be justified by the nature of the data from which the constants were established.

A Comparison of Drawing Methods—Discussion

By Lawrence F. Swenson

MOST drawings are made to serve two purposes, one being to convey in compact form information that would require several pages of manuscript if words were to be used, and the other to make a permanent record.

When information is to be conveyed, the receiver's point of view and his ability to understand are important factors to be considered, and it is well to guard against possible errors by insisting upon simplicity in all cases.

To meet the requirements, we have many practices. Some are good, but rather expensive. Others are cheap, but of little real value. A standard system somewhere between these two extremes should be worked out and universally adopted.

The most expensive system that has ever come under my notice is one that was used at an arsenal during the war. Here, a separate drawing was made for every operation that was performed, in addition to the regular forging and ordnance drawings.

The first-operation sheet showed the outline of the rough forging in dot-and-dash lines, and the surface to be machined as operation 1, in heavy solid lines. The necessary dimensions, a complete list of tools, and a description of the operation were included. The second sheet would show the outline of the piece as received from the first operation, with operation 2 indicated by solid lines. This method was continued until the completed part was shown, in some cases requiring as many as twenty sheets for a single part.

Two Sets of Sketches

Another plan I have seen in operation, is used in a plant employing about 7,000 men, with 40 draftsmen. Drawings of steel parts are blueprinted and used in the shop in the usual way. Drawings of castings are used by the pattern-maker, but small perspective sketches are made and blueprinted for the machine shop. These sketches give the necessary machining dimensions and notes, all on one view. The method makes duplicate records, and at times leads to trouble when the original drawing is changed and the shop sketch forgotten.

As an example of a poor system, I would point to the first shop mentioned by Entropy in his article on page 568, Vol. 64, of the *American Machinist*. My criticism is not directed toward the making of complete drawings, but the practice of having the shop foremen make sketches. No company should require, or allow, foremen to act as draftsmen, especially when their sketches are seldom checked.

In order to have permanent records of any value, complete and fully dimensioned drawings should be made on tracing cloth or paper from which blueprints can be obtained. Complete drawings of this kind are necessary in nearly all up-to-date drafting rooms for reference purposes.

In cases where castings are complicated and require many dimensions, the dimensions that are to be used only by the pattern-maker can be put on in red ink. This will give contrast on the blueprint, and make the machining dimensions stand out.

The above plan is recommended because of its many desirable features: complete drawings for reference purposes; accurate, permanent records; and one master drawing for each piece, that can be blueprinted or photostated. It also makes complete and accurate information available for the shop in all cases, and puts emphasis on shop dimensions when necessary.

A plan like this one is never expensive, when considered in relation to the general all-round satisfaction that is felt by everyone.

Seen and Heard

By John R. Godfrey

Times Change—But usually for the better

IF ONE is at all of a speculative turn of mind, it is interesting to think how new methods and processes change the whole complexion of industry. The stage coach gave way to the locomotive, the bicycle came, occupied the center of the stage, and then the automobile replaced it and the family horse at the same time. The cut-meter, of such limited use as perhaps 2,000 a year, became the speedometer of today, and is used by millions.

Milling took some of the work away from the planer, and the grinding machine has in turn taken work from both, not to mention taking it from the lathe and boring machine. Honing is, for the time at least, replacing the grinding of cylinders. Sheet metal has replaced many forgings and castings, and eliminated much machine work, as have die-castings.

The cord tire has replaced fabric, and the balloon drove out the high pressure tire, almost over night. Will the worm drive replace the bevel gears now in use?

But whatever changes take place, it is well to look back over the past. For although milling and grinding have supplanted planing in many cases, we are still building many and better planers. The bicycle factories are turning out wheels by the thousand. Industry changes and we must change with it, instead of bemoaning the fact that the old order passes. For industry is growing every day and we can grow with it.

There are cycles, too, in the personnel relations in the shop. The days when an apprentice lived with the boss passed years ago. The advent of big plants turned Bill and Tom into Nos. 2,785 and 3,061 on the payroll and the time clock. Individuality was lost in the era of planning every move for the worker, even to making him rest a given period. The planning department was supposed to have all the brains, and the foreman was a speed boss with nothing to do but follow instructions.

Now we are swinging back, and the foreman is a real personage, as he should be. Not the driver or the czar type, but a real leader of men.

His ideas are sought by the manager as to machine equipment and methods. The worker himself is beginning to have personality once more, and to be consulted as to things within his field. Sketches for jigs and fixtures that he is to use are shown him before they are made, to get his ideas as to improvements, or his O.K. if he hasn't any improvements to offer. For we are learning that tools and machines work better when they are welcomed into the shop.

Times are changing—but there is more work than ever to be done—and relations are improving everywhere.

Pacific Coast Railroad-Shop Methods

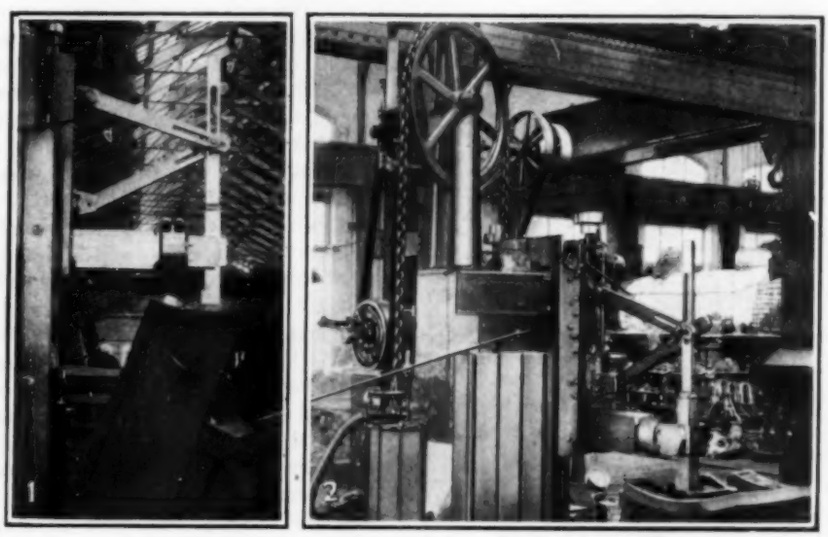
By Frank A. Stanley

Machining the arcs in cylinder saddles—Planing the seats for booster frames—Tapered fits of crossheads and piston rods—Broaching hexagon holes

FOR many operations in railroad shops, the draw cut shaper is a very useful tool, and especially so for machining cylinders and steam chests, and the planing of seats in the cylinder castings for front-end fits for side frames.

For several of the cylinder operations the work is carried upon a trunnion fixture, secured to the floor plate of the shaper, and which is so designed as to permit the cylinder casting to be swung up and set at the required angle for the proper machining of different surfaces.

One of the special operations upon this class of work as performed at the Sacramento shops of the Southern Pacific Company, is illustrated in Figs. 1 and 2. These views show the method of planing the arc in the cylinder saddle to the correct radius. The attachment for accomplishing this operation, consists of a swinging tool bar, or arm, pivoted upon a pair of supporting struts mounted upon the face of the shaper column. The swinging tool arm is adapted to be oscillated to and fro by means of a rocking connecting block, carried by the tool block on the front end of the shaper ram. The length of the pivoted arm is adjustable between the pivot and the tool block, to suit cylinder saddles of different radii, and the travel of the swinging stroke can be varied to suit the length of cut required, by adjustment of the stroke of the ram.



Figs. 1 and 2—Planing arcs in cylinder saddles

In Fig. 1, the cylinder is so placed that the arc to be planed is normal to the vertical plane; therefore a straight edge, if placed across the ends of the curved saddle would lie in horizontal position. The vertical center line through the saddle arc coincides with the center of the tool arm when that member stands vertically as shown. This position of the work results in the tool arm swinging through equal angles ahead and back of the vertical center line.

The vertical-joint face of the cylinder casting must therefore be set at a definite angle with the vertical line to bring the saddle to the position desired. This position is represented at *A* in Fig. 3. The diagram *B*, Fig. 3, shows the method by which such an angle is computed. The radius being known and also the chord of the arc, one half the chord (in this instance say 12¼ in.) is divided by the radius (here taken as 35½ in.) to get the sine of the angle. The result of this division equals 0.34506 or sin 20 deg. 11 min. or close enough to 20 deg. for all practical considerations. With this angle determined, the cylinder may readily be adjusted to correct position by its joint face, to assure proper location of the saddle arc under the shaper tool for convenience in the machining operation.

The rear end of the side frame in Fig. 4 is provided with an internal seat to form a fit for the frame of a booster engine. The frame illustrated by the sketch is about 36 ft. long and weighs approximately six tons. It is 6 in. thick and of massive design in all dimensions.

A convenient method of machining the seat for the booster frame is found in the application of the draw-cut shaper as indicated in the sketch. The rear end of the frame is strapped to the top of the shaper table and the rest of the frame is carried upon suitable supports on the shop floor. The pocket or seat shaped out in the frame is about 24 in. long and 20 in. in width.

The fitting of a piston rod end into the taper hole in the crosshead is a piece of work requiring care and skill. Piston rods are heavy, the taper fit is of considerable length in the larger sizes of rods, and the fitting of an accurate taper from end to end is by no means a simple matter. Grinding in of the rod end may be resorted to to assure a metal-to-metal fit, with no possibility of any freedom between the rod end and the taper hole.

Any minute variation in the fit of a rod end may result in a working and pounding action likely to enlarge the taper hole and lead to even greater freedom between the two members, particularly if in operation the cross head key is not set up perfectly snug to force the rod end tightly into place. The grinding-in operation illustrated in Fig. 5 obviates any possibility of improper seating of the rod end.

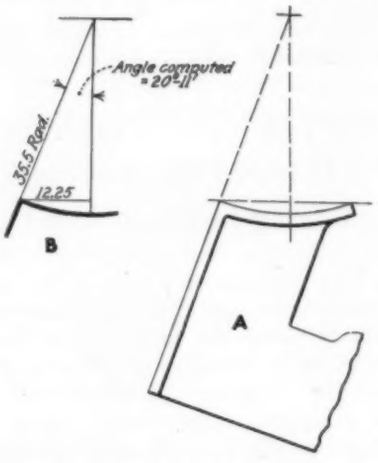


Fig. 3—How the cylinder is located

The taper hole in the crosshead is finished with reamers designed to secure a true hole of accurate taper and with a smooth wall. The reamers are cut with left-hand spiral flutes to give a smooth shearing cut without chance of crowding in to tear the surface of the metal. At right angles to the spiral a groove is cut $\frac{1}{8}$ in. deep to break up the long cutting surface. The reamer flutes are cut radially, the left hand helix being made to a lead of 62 in. The taper is one quarter inch in five inches or 0.050 per inch.

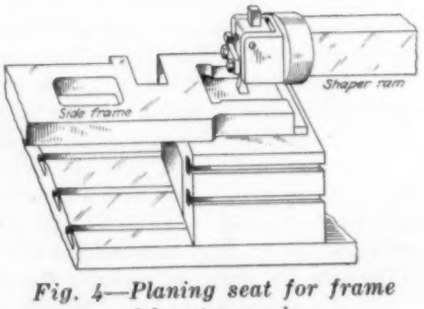


Fig. 4—Planing seat for frame of booster engine

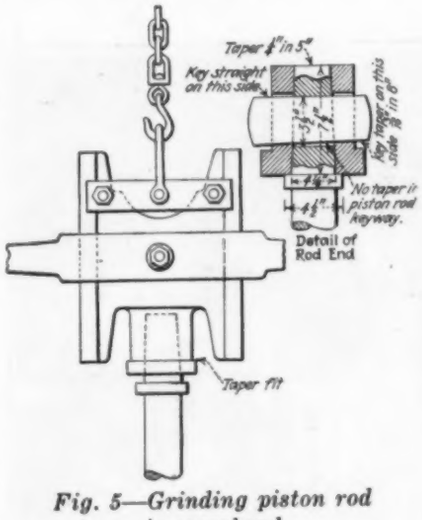


Fig. 5—Grinding piston rod in crosshead

In grinding in the rod end, about $\frac{1}{4}$ in. is left to take up by the grinding process, a matter of about 0.010 in. or so on the diameter. The rod is held upright with the crosshead suspended by a chain block. A wooden bar is secured across the face of the cross head, as in Fig. 5, to provide means for turning the head to and fro as the grinding mixture is applied. The crosshead is lowered just enough to permit of being turned back and forth, and the allowance on the taper is sufficient to assure a proper fit, so that when the key is driven home a snug and secure fit is obtained.

Broaching in a hydraulic press is the method used for machining hexagonal holes in valve cams for McKean railroad motor-cars. Holes are 1.406 in. across the flats, or 1.625 in. across corners to suit the hexagon cam shaft upon which they are operated.. After the holes have been drilled in the cams, the operation of enlarging the bore to the hexagonal form of required dimensions is accomplished with a set of three broaches.

The first broach, the rougher, is provided with 18 teeth and each of the following broaches has 22 teeth. The length is 16 in. each. The teeth have a pitch of $\frac{1}{2}$ in. and the increase in size from tooth to tooth is practically 0.0015 in. As constructed, the first teeth of the first roughing broach start cutting the flats by engaging at the corners in the bore of the cam. As the broach advances toward the larger end the edges of the teeth increase in width and the series of flats approach closer and closer to a hexagon, until the finishing broach completes the true contour and correct size. The teeth have lands of $\frac{1}{8}$ in. and the clearance is about 5 degrees.

Is There Anything the Matter with Engineering Education?

BY ENTROPY

It is always open season for gunning for college education, but the present time sees an epidemic of wholesale condemnation which does not seem to be deserved. Yet it would be too much to say that engineering education as a part of college training is beyond improvement.

The day before I acquired a sheepskin I read a paper in which I stated that I found my education had not fitted me to take the first step toward a career. I said that the only thing I could do well was to make a mechanical drawing, and that seemed to lead to the worst place from which to secure promotion. Today, 34 years later, I feel the same way. I found by the time I was old enough to be trusted with responsible work, that some of what I had learned as facts was no longer so regarded in the engineering profession. The principles remained the same but, as I recall my course, it seems to me that principles were seldom pointed out.

Now what I humbly suggest is that these two things receive more attention, that an effort be made to send out the graduate in such shape that he can expect to be of some actual use in the world of engineering the first six months, and that he be taught principles, and told that they are principles. Then after he has graduated, why should he not have the right to come back, whenever the opportunity comes of filling a responsible job and taking in all the facts regarding that specialty which the faculty and its associates may have to give?

Graduates of engineering schools go into hundreds of different jobs and a few positions. No school could possibly fit any one man to step into each of these jobs without further training, and the young man cannot possibly do more than to guess what opportunities may open before him. His final choice of profession may not come for ten or twenty years after graduation. Engineering changes very greatly in ten or twenty years. The faculty probably keeps up with the changes; if it does not, then the necessity for doing it to accommodate the graduates who come back will make them keep up to date.

The Design of Gear Tooth Forms

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Full possibilities of involute tooth forms can be realized only by sacrificing interchangeability—The 14½-deg. variable center system

WITH but few exceptions, gear tooth design today still follows the conventions established in the days of cast gear teeth. With all gear tooth forms, except the involute, there is a definite pitch line from which the conjugate forms are developed, and these forms are not conjugate to any other pitch line. With the involute, the form is developed from a base circle, and any diameter on the profile is suitable for use as a pitch circle. In fact, a definite pitch line does not exist on the involute form until two involutes are placed in contact with each other. Then the position of the pitch line depends entirely upon the size of the base circles of the two involutes and the distance between their centers.

The many valuable properties of the involute form make possible a great flexibility in its use. Every restriction imposed upon the gear tooth design, however, tends to nullify many of the possible benefits. Certain restrictions are necessary in order to obtain economy of production, but many of the restrictions now imposed are entirely unnecessary.

For example, most tooth forms employed today have equal addenda on mating gears. In order to maintain this condition, the tooth heights and pressure angles employed in any system must be constant, and are usually based on those required for the smallest effective gear of the system.

Again, most gear tooth systems are based on the use of center distances which are proportional to the numbers of teeth in the gears. This condition automatically requires a fixed pressure angle for the entire system, although a higher pressure angle would be more effective for the smaller tooth numbers and a lower pressure angle would be more effective for the larger tooth numbers.

If gear sets were always standardized commercial parts, such as many bolts and nuts, these restrictions would be necessary for the sake of economy. As a matter of fact, there is a considerable field for the use of such standardized gears. For this use, the 14½-deg. composite form is probably the most satisfactory. But this field, though large, covers a relatively small portion of the total gear requirements of today.

Manufacturing conditions of today are entirely changed from what they were at the time when the 14½-deg. composite form was developed. Considerations that once were of paramount importance have little weight now. Then, the component part of a mechanism which was made in sufficient quantities to justify the expense of special tools, such as form cutters, was a great exception. Today, such component parts are common. Furthermore, methods of molding or generating the tooth forms instead of milling them with form cutters are now in general use. Such generating processes offer many opportunities for producing improved involute gear tooth forms without the expense of special cutters.

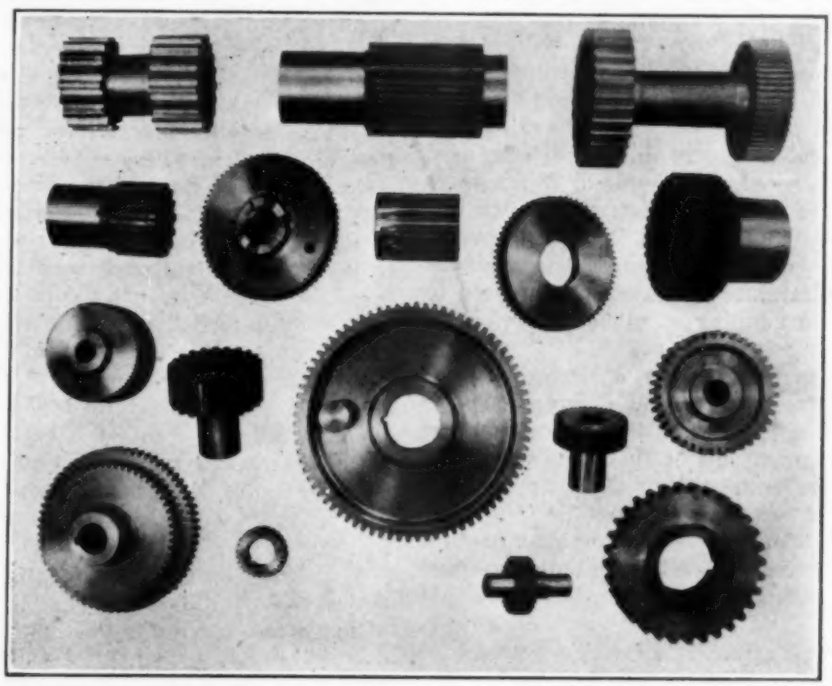


Fig. 67—Miscellaney of gears used in machine tool construction

It is true that in order to secure such improved forms, interchangeability, as the term is generally understood, will be lost. Nevertheless, all involute gears that have the same normal pitch will run together. Only proportional center distances will be lost.

The fifteenth article. The sixteenth will appear in an early issue.

Great stress is often laid upon the importance of keeping the tooth forms interchangeable at standard, or proportional, center distances. A little study will show that this feature of interchangeability is of little or no importance except for economy in tools on general jobbing work, where form milling cutters are employed, or for the convenience of the designer that desires to use only the simplest of arithmetical calculations.

A large portion of gear drives consist only of pairs, or series of pairs of gears. Universal interchangeability has no value here. Furthermore, a large portion of gear blanks can be used only in the particular place for which they are designed. This is evident from a study of Fig. 67, which shows some representative gears used in machine tool construction. Universal interchangeability of gear tooth forms has no particular value here.

The requirements and the demands that gears today are expected to meet are no mean ones and have grown with the rapid development of the manufacturing industries to such an extent that only the most accurately made and carefully designed gears can meet them. This is one reason why the manufacture of gears of all kinds is concentrated more and more in those establishments that make a specialty of it and devote all their attention and experience to it.

Conventional spur gears were unable to meet all of the more exacting requirements; hence helical and herring bone gears were introduced. Incidentally, the center distances, at which the helical gears operate, are seldom standard. Furthermore, each pair or train is complete in itself, and the tooth forms will seldom interchange with those of other pairs or trains. Yet, although they are in extensive use, this loss of interchangeability has not proved to be a great handicap.

Helical and herringbone gears are extensively used when high pitch line speeds are required. Spur gears of standard forms are seldom used when the pitch line velocities exceed 2,400 ft. per min. Yet spur gears of involute form that are accurately made and designed to secure favorable involute action are being used to transmit power when running at pitch line velocities of over 10,000 ft. per minute.

In principle, standardization is a desirable goal, because of its many economies. But if any standardization acts as a bar to progress in the art and imposes improper functional conditions, it should be abandoned or its use should be restricted to those applications the requirements of which it meets. No standard should ever be used unless it meets the peculiar requirements of functioning and service in each individual case as well as, or better than, any other construction would meet them.

The terms "functioning" and "service" are used here in their broadest sense. Service includes the furnishing to the customer of satisfactory mechanisms at reasonable cost. The requirements that gears have to meet are not always severe, particularly when their speed is low. In such cases, certain refinements are unnecessary; the best gear is the satisfactory gear that is cheapest to produce. When the speed is high, or the amount of power to be transmitted is large, or when maximum strength with minimum weight is essential, no possible refinement can be safely ignored.

The limitations of the conventional standardized interchangeable systems of gear teeth have long been known. Many suggestions have been made for improvement. In some instances increased pressure angles were proposed, the constant addendum and dedendum being still retained. In other instances, a pinion with an increased addendum was proposed, while the gear was to have a correspondingly decreased addendum, the constant tooth height and constant pressure angle being still retained.

In order to exploit the involute curve to the greatest extent as a gear tooth profile, the pressure angles and

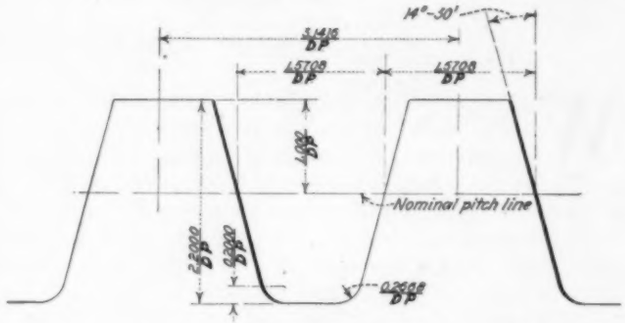


Fig. 68—Basic rack of the 14½-deg. variable center involute tooth system

the tooth proportions must be variable. If this proposal necessitated special cutting tools for every different gear tooth, the cost of producing such gears might be prohibitive. But if a generating process is used, a few standard cutters are sufficient to meet almost every condition, hence the cost of production should not be increased.

As an example of what can be done with the involute form as a gear tooth profile, we will study the possibilities of a system where a 14½-deg. basic rack of constant proportions is used to generate a series of gears, of which a 10-tooth pinion is the smallest. The only restriction placed upon the tooth design is that all gears of the same nominal pitch must be generated with the same cutter, or hob, of basic rack form.

We will establish our basic rack form first. This will be of 14½ deg. with a nominal working depth of 2.0000 in. and a clearance of 0.2000 in. for a 1-D.P. rack. This basic rack form is shown in Fig. 68. What we may call, for want of a better term, the nominal pitch line of this rack, is shown in the middle of the working depth. At this point the thickness of the tooth and the space of the basic rack are both equal to 1.5708 inches.

We first will establish the smallest pinion of the series, that of 10 teeth. We know that the small gears of any series are the critical ones. If we cut them too deep, we would have excessive undercut. If we make them too large in diameter, we would have pointed teeth. In order to avoid both of these conditions on the 10-tooth pinion, we will make its root at the undercut limit.

When E = outside radius
R = nominal pitch radius, or 14½-deg. pitch radius
a = radius of base circle
F = addendum of basic rack form cutter, including clearance

f = clearance on generating rack or hob
A = minimum root radius without undercut
H = root radius
α = pressure angle of basic rack form cutter
N = number of teeth
Pn = normal pitch.

We have the following values for the 10-tooth pinion of this series: In all cases, calculations will be based on a nominal diametral pitch of 1.

$N = 10$ teeth
$R = 5.0000$ in.
$F = 1.2000$ in.
$f = 0.2000$ in.
$\alpha = 14\frac{1}{2}°$

$a = R\cos\alpha = 4.8407$ in. [Equation (55)]
$H = A = R\cos^2\alpha - f = 4.4866$ in. [Equation (60)]

The next step will be to determine the thickness of the tooth of this 10-tooth pinion on its 14½-deg. pitch line.

When CP = circular pitch of basic rack form cutter
G = distance from center of gear to top of rack tooth
T = tooth thickness of gear at R.

$$T = 2\tan\alpha(G + F - R) + \frac{CP}{2} \quad \text{[Equation (50)]}$$

In this example, $CP = 3.1416$ in.
$G = H = 4.4866$ in.
$F = 1.2000$ in.
$R = 5.0000$ in.

Whence $T = 1.9259$ in., which is the thickness of the tooth of the 10-tooth pinion on its 14½-deg. pitch line.

The next step will be to determine at what center distance two of these two 10-tooth pinions will mesh together without backlash. All of these gear calculations are made for gears without backlash. Backlash is obtained by cutting deeper. We have from problem 9 in the seventh article,

$$\text{inv}\,\alpha_2 = \frac{T}{2R} - \frac{\pi}{2N} + \text{inv}\,\alpha_1 \quad \text{[Equation (45)]}$$

$$C_2 = \frac{2R\cos\alpha_1}{\cos\alpha_2} \quad \text{[Equation (46)]}$$

Where α_1 = pressure angle of cutter
α_2 = pressure angle between gears when meshed
C_2 = center distance between gears when meshed.

Whence $\text{inv}\,\alpha_2 = \frac{1.9259}{10} - \frac{3.1416}{20} + 0.005545 = 0.041056.$

From the table of involute functions in the seventh article we get,

$\alpha_2 = 27° - 36'$ whence $\cos\alpha_2 = 0.88620$

Thus $C_2 = \frac{10 \times 0.96815}{0.88620} = 10.9247$ in.

We will next determine the tooth depth for this pair of gears. The center distance is 10.9247 in., and since the sum of the root radii equals twice H or 8.9731 in., a distance of 1.9516 in. is left between the roots of this pair of gears. This distance must include the working depth of tooth and two clearances. The clearance on the basic rack is one-tenth of the working depth, and we will maintain this proportion, whence

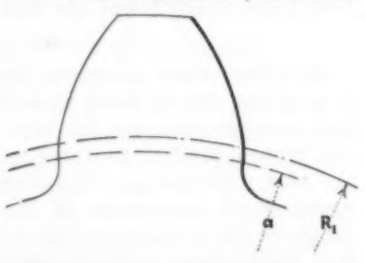


Fig. 69—Form of 10-tooth pinion of the 14½-deg. variable center involute system

1.200 × working depth = 1.9516 in.
whence working depth = 1.6263 in.
clearance = 0.1626 in.
tooth depth = 1.7890 in.
And $E = H + 1.7890 = 6.2756$ in.

We will now check this tooth form to be sure that the tooth is not pointed. We have from problem 6 in the seventh article,

$$\cos\alpha_2 = \frac{r_1\cos\alpha_1}{r_2} \quad \text{[Equation (39)]}$$

$$T_2 = 2r_2\left(\frac{T_1}{2r_1} + \text{inv}\,\alpha_1 - \text{inv}\,\alpha_2\right) \quad \text{[Equation (40)]}$$

T_2 = thickness of tooth at r_2, or outside radius in this case.

$r_2 = 6.2755$ in.
$r_1 = 5.0000$ in.
$T_1 = 1.9259$ in.
$\alpha_1 = 14\frac{1}{2}°$

$$\cos\alpha_2 = \frac{4.84074}{6.2755} = 0.77137$$

$\alpha_2 = 39° - 31'$ and $\text{inv}\,\alpha_2 = 0.13513$

$$T_2 = 12.5510\left(\frac{1.92591}{10} + 0.005545 - 0.13513\right) = 0.7907 \text{ in.}$$

The form of this pinion tooth is shown in Fig. 69.

We will also determine the radius at which this tooth becomes pointed, which will establish the maximum tooth depth that this pinion could possibly have. We have from problem 7 in the seventh article:

$$\text{inv}\,\alpha_2 = \frac{T_1}{2r_1} + \text{inv}\,\alpha_1 \quad \text{[Equation (41)]}$$

$$r_2 = \frac{r_1\cos\alpha_1}{\cos\alpha_2} \quad \text{[Equation (42)]}$$

Where $r_1 = 5.0000$ in. = known pitch radius
$\alpha_1 = 14\frac{1}{2}°$ = known pressure angle at r_1
$T_1 = 1.9259$ in. = known tooth thickness at r_1
r_2 = radius where tooth is pointed.

Whence $\text{inv}\,\alpha_2 = \frac{1.92591}{10} + 0.005545 = 0.198136$

From the table of involute functions in the seventh article we get:

$\alpha_2 = 44° - 1'$, whence $\cos\alpha_2 = 0.71914$

and $r_2 = \frac{4.84074}{0.71914} = 6.7312$ in.

As the root radius equals 4.4866 in., the maximum tooth depth possible on this 10-tooth pinion would be 2.2446 in. This is greater than the basic rack tooth depth, which is the maximum that could ever be employed.

We will now examine the exact conditions between these two pinions. We have from the eighth article. Number of teeth in contact =

$$\frac{\sqrt{E_1^2 - a_1^2} + \sqrt{E_2^2 - a_2^2} - C\sin\alpha}{Pn} \quad \text{[Equation (58)]}$$

In this example both gears are identical.

$\sqrt{E^2 - a^2} = 3.9924$

$$Pn = \frac{2\pi a}{N} = 3.0415 \text{ in.} \quad \text{[Equation (57)]}$$

$\alpha = 27° - 36'$

$C\sin\alpha = 5.0614$

Whence contact $= \frac{2.9234}{3.04153} = 0.961$ tooth intervals.

This contact does not give an overlap, so that this pair should not be used for the transmission of power.

Turret Tooling for Transmission Levers

By I. F. Yeomans

TRANSMISSION levers, such as shown in Fig. 1, are long and awkward to machine. The $\frac{3}{4}$ in. diameter *A* must be turned, the shoulder faced as at *C* and a groove turned as shown in Fig. 2. The hole *B* is first drilled and reamed, and serves as a locating

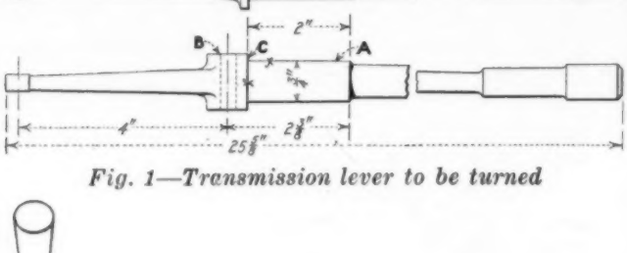


Fig. 1—Transmission lever to be turned

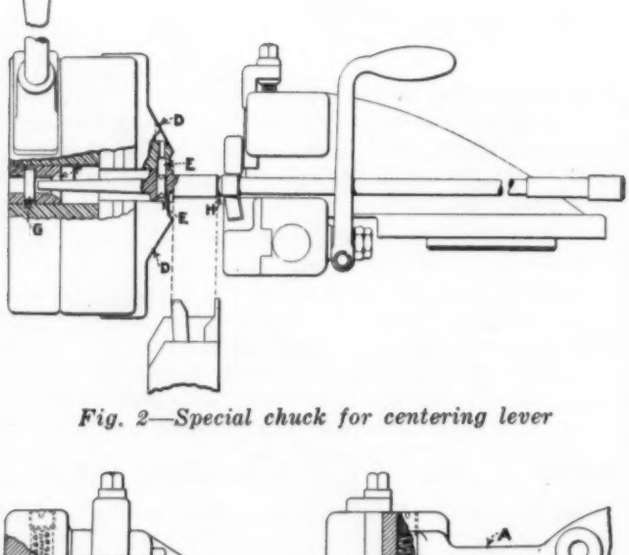


Fig. 2—Special chuck for centering lever

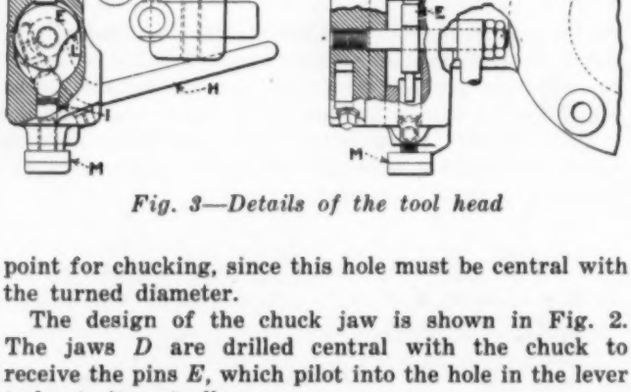


Fig. 3—Details of the tool head

point for chucking, since this hole must be central with the turned diameter.

The design of the chuck jaw is shown in Fig. 2. The jaws *D* are drilled central with the chuck to receive the pins *E*, which pilot into the hole in the lever to locate it centrally.

The pilot bushing *F*, pressed into the bore of the chuck, has a rectangular hole to receive the end of the lever and aligns the lever lengthwise with the spindle of the machine. Pin *G*, through the pilot bushing, acts as a stop and aids in quickly locating the reamed hole over the locating pins *E* in the chuck jaws. The

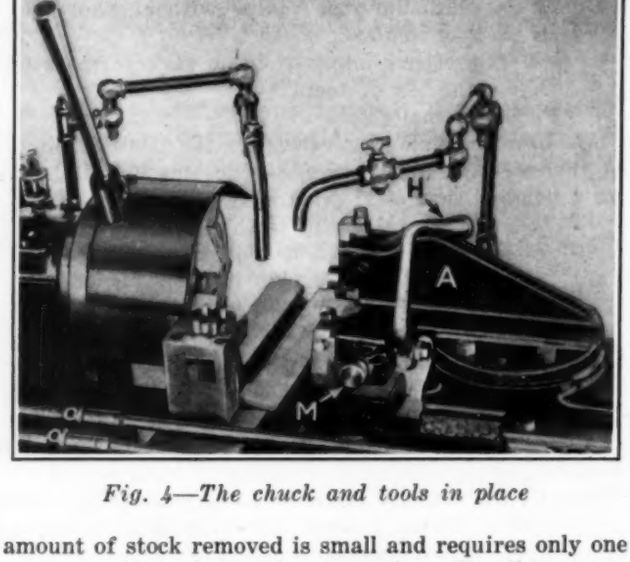


Fig. 4—The chuck and tools in place

amount of stock removed is small and requires only one cut to complete the turning operation. For this operation the turret was removed from a No. 3 Foster plain-head screw machine and the special turning tool mounted directly on the turret slide in place of the turret. Provision was made for backing the cutter from the work so that the lever could be passed over the cutter and under the roller rests. The shoulder *C*, Fig. 1, and the groove, *H*, Fig. 2, were cut by tools in the cross-slide.

The tool consists of a cast body *A*, Fig. 3, into which is dovetailed the slide *C*, slotted to receive the cutter. The shaft operated by the lever *H* passes through and is keyed to the cam *E*. The shaft is also piloted and threaded into the slide *C*. A cavity is cored in the body *A* to receive the cam *E*. The body is drilled and reamed to receive the roller plunger *I*, which, in turn, is adjusted by the screw *M*. This screw also adjusts the depth of the cut, diametrically opposite the roller plunger.

A backward movement of the lever *H* rotates the cam *E* and allows the spring plunger *K* to force the cam, slide, and all away from the work to the distance of the fall in the cam at *L*. After the work is inserted in the chuck, a forward movement of lever *H* to the position shown, sets the cutter to the depth for which it is adjusted by the screw *M*. The lever *H* also clamps the slide securely between the threaded portions of the shaft in the slide and the adjusting nuts at the outer end of the lever. The lever is a sliding fit over the shaft and is retained to the latter by means of a Woodruff key.

The method shown can be successfully applied to many other forms of similar tools to advantage. In Fig. 4 the toolslide and the tool set-up is shown.

Now that steels are being largely known by numbers it is of interest to know what the numbers mean. The first number indicates the type of steel (1) being used for carbon steels, (2) for straight nickel and (3) for the nickel chromium. The second number indicates the approximate percentage of the alloy and the last two numbers the average carbon content in "points." Thus No. 1020 means straight carbon steel of 20 "points" carbon. The cipher after the first figure shows there is no alloy used. No. 2315 indicates nickel steel of approximately 3 per cent, and 15 "points" of carbon.

The Screw Conveyor and Its Manufacture

By D. C. Wright

Methods of piercing rivet holes in sectional flight circles—Forming or shaping the sections—Continuous flight conveyors and their construction

HAVING obtained the flight circle or section as described in the previous article, the manufacturer can next pierce the rivet holes by means of which each section is attached to its neighbor. Here we again run into those elements in flight forming which, while not incurable, are curable at a price that is not justified by the circumstances. These elements are variation in texture, thickness and forming temperature which, in their turn, cause slight variations in forming. This makes it practically impossible to line up all rivet holes in any pair of end joints.

In the case of stock sizes, the alignment of the holes is usually attempted as a possible sales point and as a help to the customer who desires to purchase spare or replacement flights. At the same time it must be remembered that there will be times when one of the two holes will fail to match with the corresponding one and adjustments will have to be made. This applies, of course, to the general practice of piercing the rivet holes while the flight blank is still in the flat.

The writer devised a method at one time, which has since been followed in some plants and which may, of course, not have been original with him, wherein the piercing of the holes was left until after the flight had been formed. Care should be taken, however, to see

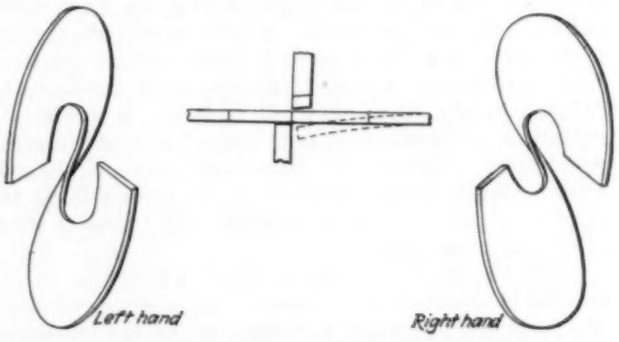


Fig. 11—Splitting right- and left-hand flight circles

that the splitting operation is performed against an exact radial line of the flight circle. With this as a positive starting point from which to locate, it is an easy matter to punch rivet holes so that they will match those which are similarly located. The more common practice, however, is still to punch all the holes on one end and the center hole in the other end.

In other words, one pair of holes can always be brought into alignment and the single hole of the remaining pairs can then be used as a guide or templet in punching through and completing the combination. Whichever method is employed, the holes are either punched at one operation by a gang punch, in the case of standard sizes, or singly by means of a layout or templet on odd sizes.

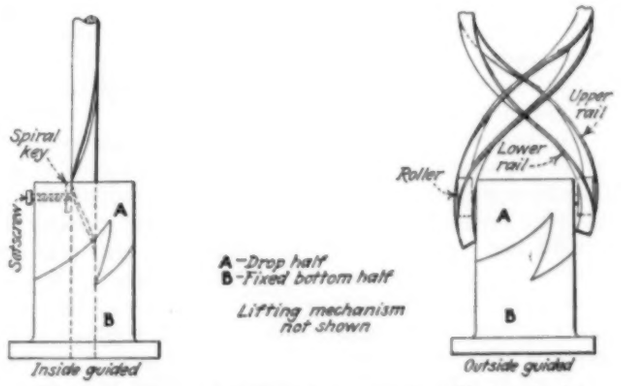


Fig. 12—Types of drop formers for flight circles

The final operation in preparing the ordinary flight circle is known as "splitting" and consists simply of making a shear cut radially across the ring or circle, midway between the rows of rivet holes produced by the above operation. This work is performed on a standard power shear which, as a matter of convenience should be equipped to cut either right or left hand. The reason for this can be seen in Fig. 11. In the heavier thicknesses of metal it is often difficult to spring the ends past each other into the opposite spiral relationship, in the event that the circle is to be formed to an opposite "hand."

Before passing on to the forming operations, it should be mentioned that all special operations, such as notching out the center hole to a larger diameter for a portion of its circumference in order to make it fit over the reinforcing collar used on the ends of the center pipe or "backbone," as well as the introduction of mixing holes, flaps or cuts in the flight itself, should be done in the flat before the splitting operation.

There is a great divergence of opinion as to what is the best practice for the forming or shaping operations on sectional flight conveyors. The practice most generally adhered to is one wherein the circles, after being heated to a proper temperature are shaped between heavy cast-iron formers. Here, again, enters a further difference in practice, resulting in a somewhat differently finished product.

The second part of a three-part article. The third will appear in an early issue.

Some shops follow the practice of bringing the mating halves of these forms into engagement by means of some form of drop press wherein the upper half of the forms is provided with sufficient weight to enable it in its fall to generate the power required to force the heated metal into the desired shape or form. A second method provides for the mounting of the forming blocks on the ram and block, respectively, of a "bulldozer" or forming press so set as to bring the shaped surfaces together a little before the extreme inner end of the stroke is reached, thus producing a "squeeze" against the back springs of the machine.

When it is remembered that a complete flight circle in the course of its alteration into a helical spiral overlaps its ends approximately 30 deg., it becomes evident that the shape of the forming blocks must, of necessity, be such that the two halves cannot be brought into engagement by merely moving them toward each other along a common plane. They must be "screwed" into each other, so to speak, along their common axis during their travel along the plane. This is accomplished, in the case of the drop-type forming blocks, as in Fig. 12, by means of a spiral keyway in a center bearing shaft over which the falling member travels or else the twisting movement is imparted by means of a spiral track about the outside of the form, which engages with proper pins or rollers on the drop itself.

Of these two methods described, the latter is the more satisfactory mechanically because the point of application of the twisting force is removed as far as possible from the center of rotation. This reduces the strain and, consequently, the wear to as great an extent as the limitations of size will permit. It also allows the use of a larger and heavier drop that will more accurately form the material worked upon. This method also has the advantage of eliminating the central guide altogether, if necessary. For this reason,

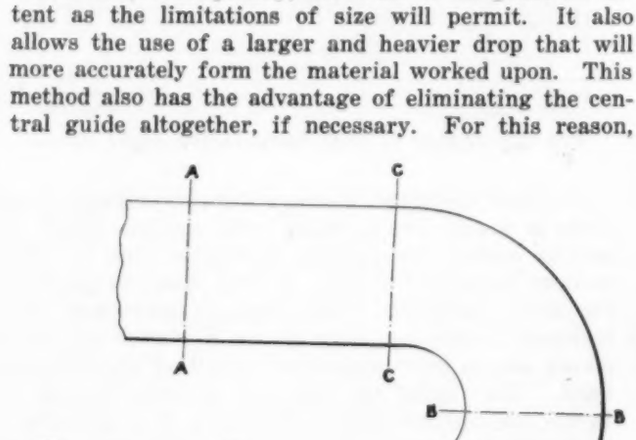


Fig. 13—Cross-sectional distortion in continuous flight rolling

the forming of the blanks can be without reference to the size of their central holes. The advantage is a great one when dealing with the often weird specifications that a conveyor maker is called upon to meet.

In the case of the bulldozer, the twisting motion of the block is imparted by means of a rack and arm which, through the medium of a spiral pinion twists the ram head about its axis to the proper amount.

There is much discussion as to the relative merits of the two methods of forming and both, in the hands of operators who know their business, produce good results. From the metallurgical standpoint, however, it is a question whether the gradual, steady drawing action of the bulldozer does not produce a more natural adjustment of the metal structure to its new shape than the sudden, almost tearing action of the drop. The writer has seen flights literally torn apart under a drop type of former while the same sort of blank took the desired shape perfectly in a bulldozer. A skilled operator can adjust the position of contact so

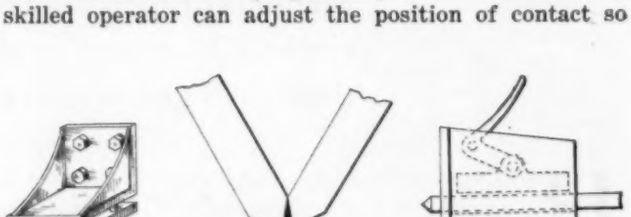


Fig. 14—Continuous-spiral rolling equipment details

as to produce "tight" or "loose" flights at will, on a bulldozer. The possible manipulation of a drop is not nearly so pronounced.

Except in the case of light weight, soft material, both of the methods described require the operation of a furnace. In the summer the heating operation results in a considerable loss of time. To overcome this disadvantage some manufacturers are using the rolling method for forming the flights. This method calls for a special type of machine consisting essentially of two conical rollers driven by means of suitable gearing in such a manner as to bring the conical ends together along a line contact. It is not a true rolling operation in that the forming is actually done by means of guides through which the band of metal is fed from the two conical rolls. Very satisfactory results are obtained from the rolling method.

A great deal of stress must be laid upon the proper determination of the best proportions of the flight circle and the design of the guide. In other words, the perfect flight must first be a perfect circle with proportions such as to permit a proper adjustment of metal in the finished flight. This method, however, is subject to variations in the material used since it is a cold-treating proposition. Where, as frequently happens, "hard" spots or whole sheets appear in a lot, these will, in the nature of things, take a different "set" than a sheet of standard material.

Since the costs increase in direct proportion to the amount of discrimination used in the purchase of material, it would be unwise to tighten up on the inspection standards merely to eliminate a reasonable percentage of defectively formed flights resulting from variation in material. Especially is this true when it is realized that it is a comparatively easy matter, in most cases, to correct this poor forming by hand work on the bench and thus to salvage at slight cost what little poor work there may be.

It has frequently been claimed that the rolling method produces flights of sufficient uniformity to permit the piecing together of these flights with a perfect matching of rivet holes even where these holes were pierced before the forming operation. This claim, however, is not borne out in practice. So long as the variation in sheets exists the necessary uniformity of hole loca-

tion will not be found. The relative merits of the various methods of flight forming seem to show a slight advantage in favor of the rolling process because of the elimination of the necessity of heat with its attending expense of furnace, fuel and handling.

Although it was recognized that under certain conditions there was a distinct disadvantage in the resistance offered to the progress of material past the joints in a sectional conveyor and wherever this could be corrected it was accomplished by the use of cast spirals, turned spirals or by the use of a sectional conveyor with the joints filled in, there was no really satisfactory substitute until the invention of the so-called "helicoid" flight in the latter part of the last century and until the development of machinery for its manufacture.

This form of flight, which has grown to be very popular and whose manufacture in one form or another has been taken up on a large scale, is merely the development of the idea that if a rectangular cross-section be so compressed as to make its section approximately triangular, with the base equivalent to the original thickness of the metal and the height no greater than the length of the original parallelogram, then the form of the piece must change from a rectangle to a segment of a circle, as shown in Fig. 13, whose inside and outside arcs will vary in proportion to the distortion of the cross-section. In other words, compressing the one edge of a piece of and preventing the flow of stock in a radial direction necessitates the elongation of the edge compressed. This elongation, if properly controlled can be made to produce a circle. In Fig. 13, which is a sketch showing the nature of distortion of the stock in continuous flight rolling, the line *C-C* is the line of roll contact. The section *A-A* shows the original cross-section dimensions while the section *B-B* shows the new dimensions, the base thickness being approximately the same as originally.

Until recently the flighting of this type of conveyor has been entirely of the type which tapers in its cross-section toward the outer edge. It has been realized, however, that under proper methods of manipulation, the gross mass of a given piece of stock could be so rearranged in rolling as to produce a spiral with a rectangular cross-section or with a cross-section even heavier at the outer edge than at the center, if desired. The chief value of these two last mentioned types lies in their ability for being cut up into "sectional" flights with matched ends without the necessity for putting them through all of the operations necessary in obtaining the circle which is generally used as the basis of sectional flighting.

The type of flight first mentioned, having its heavier section at the center, is ideal for most purposes in that its stiffness is enhanced by the additional metal at the point where the operating strains are greatest.

In practice the continuous type of flight is made both by the hot and by the cold process. The latter, however, requires so much heavier equipment that it is used only on the smaller and lighter sizes of metal. With the hot rolling method, the application of heat so increases the ductility of the metal that even the largest of the ordinary commercial sizes can be handled successfully. The equipment for both the hot and the cold rolling processes is essentially the same. As shown in Fig. 14, it consists of conical rollers so hung in a vertical plane by means of appropriate transmissions that their point of contact is conveniently accessible to the operator. In the case of hot rolling the rolls are directly in front of and on a level with the floor of the strip-heating furnace.

In leaving the rolls, the spiral, which normally runs from ten to fourteen feet in length, is caught and supported by a trough, in the case of the cold rolling process, and by a rod over which it winds itself, in the case of the hot rolling method. The rod is then conveyed by hand or trolley to a quenching tank from which it emerges ready for use.

Under a good many conditions, either in manufacturing processes or in the case of peculiar characteristics in the material handled, a type of screw conveyor presenting a solid surface is undesirable. Perhaps the material is of such a nature as to encourage packing or clogging, perhaps it is desired to have a tempering or mixing action included in the conveying operation.

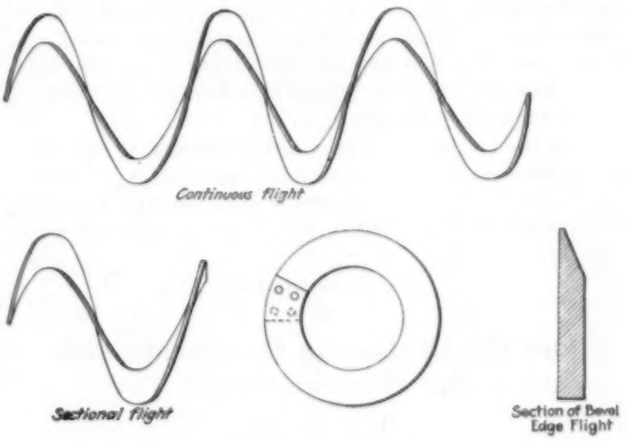


Fig. 15—Forms of ribbon flighting

Sticky materials such as asphalt, molasses, sugar, hot tar and the like are particularly likely to collect on any broad surface continually brought into contact with them. Under such conditions, a so-called "ribbon" conveyor in one form or another is ideal. This type is illustrated in Fig. 15 in both the sectional and continuous styles.

The capacity of a ribbon spiral under such conditions is substantially the same as that of a solid flight spiral, since the tendency is for the whole mass to follow the outer section which, in this case is naturally propelled by the ribbon spiral. The ribbon conveyor has various forms, notably the continuous flight and the sectional flight, as in the case of the solid surface conveyor, and the "bevel edge" type which is a modified form of both of the others.

The continuous flight ribbon can be rolled very much in the same way as the continuous solid flight, having in this case a cross-section slightly tapered and very much of the same shape as would be expected if one was to cut a clean strip from the outer edge of a regular continuous flight.

Under certain conditions in some shops the practice is followed of rolling spirals up on ordinary lathes, creating the pitch either by means of a follower block on the cross-slide or else by securing one end and pulling the other end out by means of a tackle or crane until the metal takes a "set."

Sectional ribbon, which is occasionally desired for

the same reason as a sectional conveyor of the solid type, is made in one of two ways. The first is by the preparation of a circle, as in the case of the solid type of flight and the second is by winding up a circular coil by forming in a bulldozer between a curved ram and a round block.

After the circle is formed by either of these two methods it is given its final pitch and shape in the same die forms as are used in the making of solid sectional flight.

Bevel edge ribbon is a kind that is frequently found useful and specified in cases where there is a tendency for the conveyed material to cake along the bottom of the trough. By the use of a beveled edge on the conveyor blade and by hanging this conveyor low enough in the box or trough to permit a scraping action, such an accumulation is prevented and the material is kept in motion.

Flights of the above type are customarily made in the form of sectional ribbon from circles which have been produced either wholly in a lathe from plates, or, if they are of a size which corresponds to an available punch and die, they are placed in the lathe and beveled on the edge after blanking.

Since the introduction of welding torches, it has been found possible to produce a highly satisfactory continuous flight of any type by simply butt-welding the ends of sectional flights together and dressing them off with a portable grinder.

(To be concluded)

Does the Draftsman Co-operate with the Machine Shop?

By J. Davies
Oshawa, Ont., Canada

The faults of the draftsman are of omission rather than commission. It is much easier and carries less responsibility to say, "This collar is to be shrunk on," than it is to calculate the amount that should be allowed for shrinkage, and give an exact size. The average mechanic hates to have to confess to his foreman that he cannot read the blueprint. A little more thought and trouble on the part of the draftsman would often save much confusion and time in the shop.

I have often seen blueprints that would require the services of a Sherlock Holmes to decipher them, had we no other source of information than the blueprints themselves. The average mechanic is a very poor mathematician, and the drafting department should make all the calculations needed on any drawing.

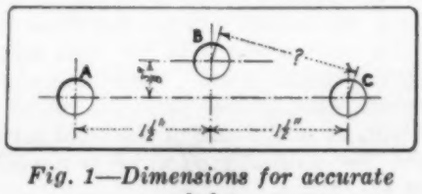


Fig. 1—Dimensions for accurate holes

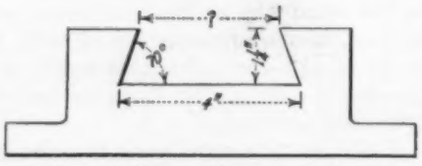


Fig. 2—Dimension needed for dovetail

In any piece of work with a number of sizes, such as a shaft, details of the length of the different parts, such as bearings, are given, but the overall length is often omitted. The first operation on such a job is facing the shaft to the overall length. I have seen machinists having a strenuous time trying to add up a number of fractions and decimals to obtain the overall length of a piece of work.

In Fig. 1 is shown a sketch of the base of a bracket used on the four-wheel brake system of a prominent motor company, just as it came to the tool room. From a draftsman's view point, the sketch shows all the necessary dimensions, but from the viewpoint of the toolmaker, who had to make a drill jig, the distance *B* to *C*, which was omitted, is very important. This job was done by locating buttons in the required position, and indicating in the lathe. If this dimension *B* to *C* had been given it would have simplified the locating of the buttons.

Another job, shown in Fig. 2, was spoiled for the want of a dimension which the drafting department could easily have given, but which the planer was unable to work out for himself. The planer hand measured the casting across the wide end of the dovetail, where the blueprint showed a dimension of 4 in., and found that it measured 3¾ in. He concluded that he had ¼ in. of material to take off, but unfortunately the casting was not 70 deg., and he had not more than 1/8 in. to take off the small end. He put on a heavy cut, after setting the planer head for 70 deg., and found to his dismay that when his cut was at the bottom of the dovetail it measured more than 4 in. This obviously would not have happened had the dimensions at the top been given.

I have seen several jobs spoiled owing to the different way Englishmen and Americans project their drawings. Whenever it is possible for a drawing to be misread in this manner, care should be taken to specify clearly what each elevation represents. In most drawings there is sufficient difference to know which way the elevation is taken, but in cases where the difference is slight the draftsman should specify the direction of his elevations.

Blueprints from Blueprints

By John F. Hardecker

As Jack Smith and Bill Brown, pals and fellow chief draftsmen, were teeing off for their Sunday morning round of golf, Jack noticed that Bill was rather quiet and thoughtful. Finally Jack put the question to him.

"You remember that South American machine job I told you we were expecting to get," replied Bill. "Well, we got it, but it came in with a full set of detailed blueprints, and a request that we advance our delivery date a month as a consequence of not having to develop the details. As we are a large organization, we need lots of prints, particularly since they have machined parts, castings, sheet metal, and so forth all on the same blueprint. To attempt to get tracings or vandykes from South America or to retrace is out of the question, and to photostat the required number of prints of each blueprint is going to be quite expensive."

"But," put in Jack, "if they are good blueprints, with clear, legible lines, your problem is not so hard. If you'll make a single clear photostat of each blueprint, you can blueprint from the photostat. It's quite simple too, merely reduce your blueprint machine speed to about one-third of what you normally use, which will bring you close to the minimum speed. Then go to it."

Rejuvenating a Historic Plant

Old machines have been scrapped, new equipment has been installed and departments have been arranged at the works of the Pratt & Whitney Company

DURING the past few months the plant of the Pratt & Whitney Co. of Hartford, Conn., under the management of Clayton R. Burt has been undergoing extensive changes calculated to co-ordinate the executive and working forces to a greater degree, to bring its equipment up to date in every respect, and to improve the facilities for the manufacture of its product.

The offices of the Small Tool Division, hitherto located in the factory building of that plant at the corner of Flower St., have been moved into the main office building on Capitol Ave., and a three-decked inclosed bridge has been built to connect this building directly with the engineering offices and thus to render it more conveniently accessible to all parts of the plant. Mr. Charles M. Pond remains in charge of the Small Tool Division with an office on the ground floor of the main office building.

The reasons for making the changes in the offices and shops are twofold. First is the concentration of the working forces into smaller compass: reducing the amount of power required to drive the machinery by reducing the number of motors; cutting out a great deal of hitherto necessary transportation, not only of raw material but of finished and partly finished product; making for greater convenience in handling the work in progress; and reducing the cost of supervision as well as making it easier for the office to keep in touch with the operations of the factory. Second, is the conservation of floor space.

Old Tools Eliminated

The rearrangement of departments provided opportunity to eliminate obsolete, old and insufficiently productive machinery and methods, for which the most modern of equipment and the latest improved practices have been substituted. In selecting equipment for the renovated departments there was but one consideration; to get the machine best adapted to handle each job.

Another improvement which the transfer of entire departments from one location to another rendered possible was the thorough rehabilitation of the working quarters. New floors were laid, new partitions erected where necessary, and the walls and ceilings painted. From the floors to the five foot level the color is a blue-gray; dark enough to resist discoloration for a considerable length of time, yet not sufficiently dark to absorb light to any great degree. Above the five-foot level the walls and supporting columns are painted white, as are also the ceilings and overhead timbers. This color scheme is followed throughout the entire plant.

Moving without Delays

Before starting the work of moving a department the layout for the new location was planned in every detail. All necessary overhead shafting was hung and motors installed where group drive was contemplated; office inclosures or deck spaces for the foremen and supervisory forces were provided; and the electric wiring for lights and for the motors of individually driven machines was put in. Every advantage was also taken of the facilities for natural lighting; resulting in cheerful and pleasant work rooms.

Each item of equipment that was to be moved was marked for the space it was to occupy, all new machines planned for the department were placed, and in the transfer all machines slated for elimination were shunted to the scrap yard or to storage, according to their value. In this way it was possible to move an entire department without serious delay to the work in progress, and when the transfer was completed the department would be in occupation of what was virtually a new shop.

In the rearrangement it was found possible to bring the departments into much closer co-ordination than had heretofore existed. So far as it is possible to bring about this condition, each unit of the product is

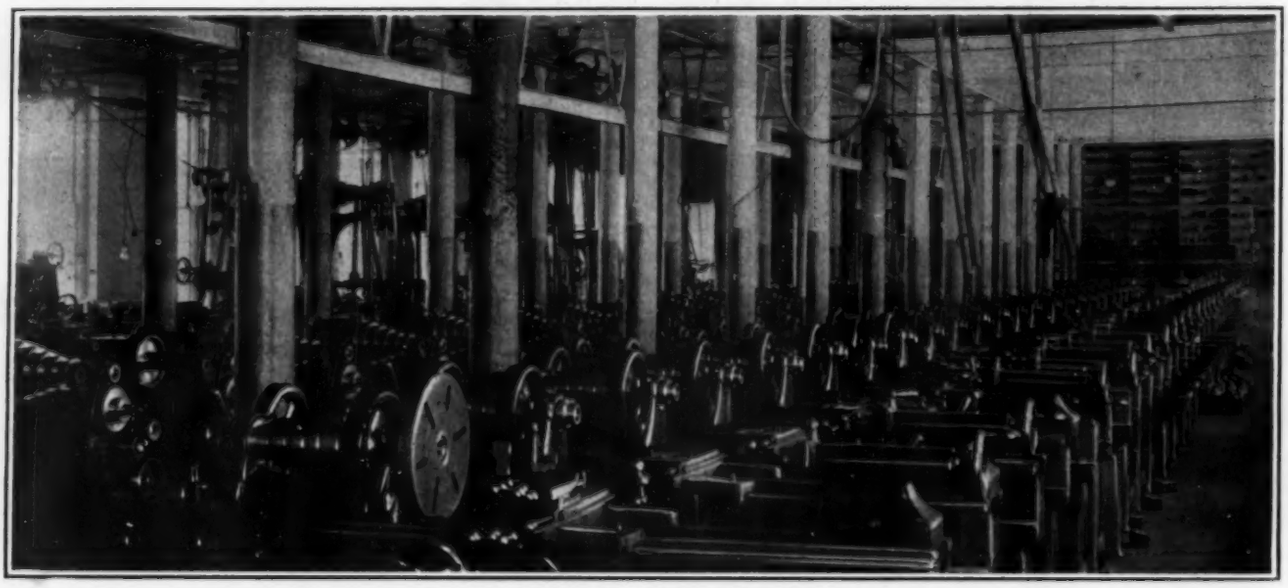
The drafting room in 1900 and as it looks today

The toolroom as it appeared before the reorganization

Heavy machinery department four years ago

now concentrated in its own building. Production operations, parts assembly, final assembly and testing of machines now follow in orderly sequence without the necessity for trucking parts back and forth from one place to another.

Naturally, the concentration of the working forces left considerable floor space that could be turned to revenue-producing advantage. Not the least consideration in this respect is the new Pratt & Whitney Aircraft Co., a subsidiary of the parent corporation, which will soon occupy one entire building that has been vacated by the changes. The Aircraft company manufactures a 400-hp. 9-cylinder radial engine for airplanes, which engine weighs but 1½ lb. per horsepower and is claimed to be the lightest engine per unit of weight in the world.



A corner of the lathe assembly floor as it looked 25 years ago

The toolroom as rearranged has better light

The Aircraft company is equipped with new machinery throughout, and its production program calls for a yearly output of 200 engines. All parts of the engine are manufactured in the plant, and at the rear of the yard there are three testing stands, housed in separate buildings and provided with elaborate machinery to determine the horsepower and efficiency of the engines. Each engine will be given a running test of approximately 15 hours. Mr. George Meade, whose long experience in the field of aviation machinery has eminently fitted him for the position, is in charge.

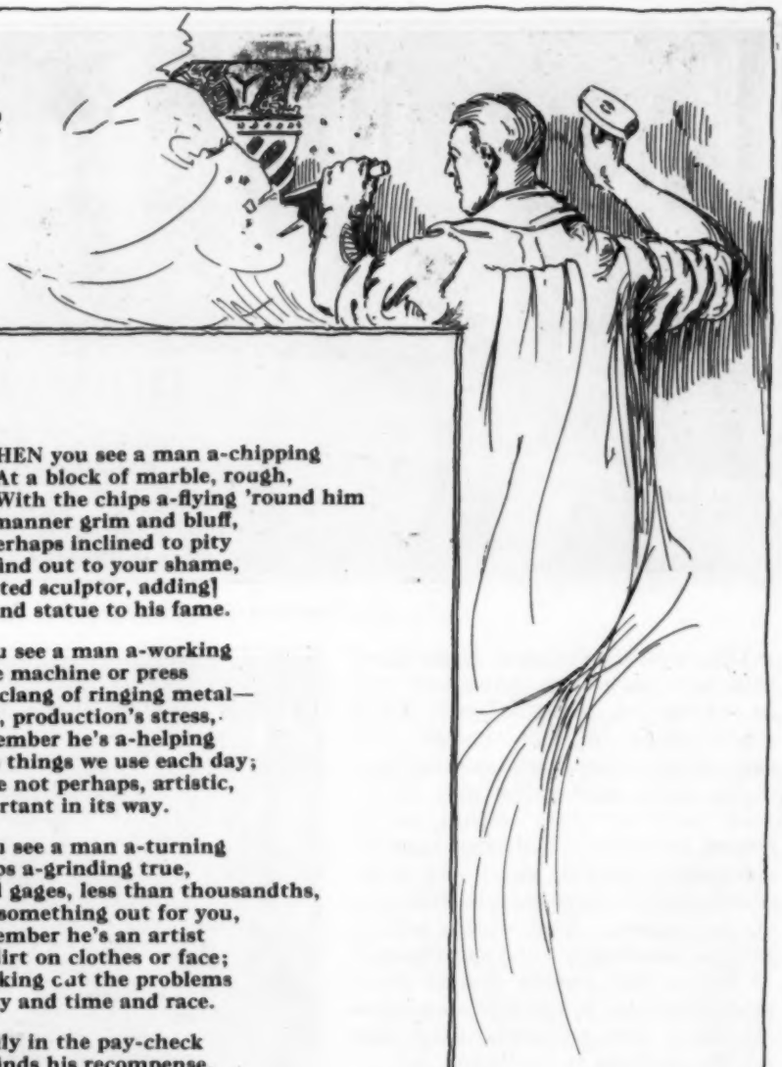
The illustrations show the changes that have been made in some of the departments and indicate the possibilities latent in old buildings when drastic rearrangement is determined upon.

Heavy machinery department as it looks now

A corner of the lathe assembly floor in the present plant

There's a Romance In the Making

By LORING ROPER



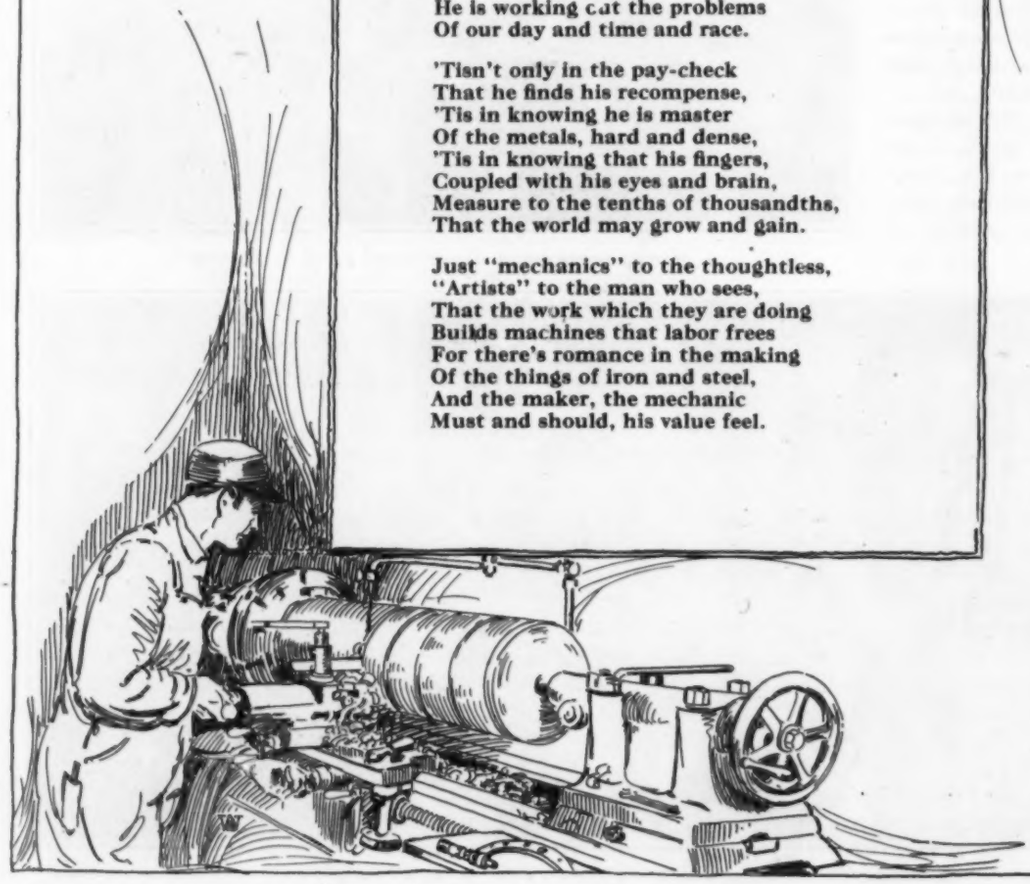
WHEN you see a man a-chipping
At a block of marble, rough,
With the chips a-flying 'round him
And his manner grim and bluff,
You're perhaps inclined to pity
Till you find out to your shame,
He's a noted sculptor, adding
Some grand statue to his fame.

When you see a man a-working
At a huge machine or press
'Mid the clang of ringing metal—
All about, production's stress,
Just remember he's a-helping
Build the things we use each day;
And while not perhaps, artistic,
'Tis important in its way.

When you see a man a-turning
Or perhaps a-grinding true,
Tools and gages, less than thousandths,
Working something out for you,
Just remember he's an artist
Spite of dirt on clothes or face;
He is working out the problems
Of our day and time and race.

'Tisn't only in the pay-check
That he finds his recompense,
'Tis in knowing he is master
Of the metals, hard and dense,
'Tis in knowing that his fingers,
Coupled with his eyes and brain,
Measure to the tenths of thousandths,
That the world may grow and gain.

Just "mechanics" to the thoughtless,
"Artists" to the man who sees,
That the work which they are doing
Builds machines that labor frees
For there's romance in the making
Of the things of iron and steel,
And the maker, the mechanic
Must and should, his value feel.



Automotive Production

Fixtures and Methods in Machining Hupp Cylinders

By Fred H. Colvin
Editor, *American Machinist*

Illustrations of the adaptation of existing equipment — Conveyors speed operations — System of tagging shows what operations have been completed

IN CHANGING from the 4-cylinder engine to the 6-cylinder, the Hupp Motor Car Co. very naturally planned to utilize its present machine equipment until manufacture of the new engine was well under way. For this reason some of the methods illustrated herewith may be changed during the present year. And for the same reason the methods shown are of value, as suggesting how work can be done in shops that are not equipped with a mass of special machinery.

The first operation is to mill the bottom surfaces of the cylinder flanges in the heavy fixtures shown in Fig. 1. How well the flanges are supported can be seen by noting the wedges *A* and *B* and the plugs *C*, the latter of which take the thrust of the milling cutters and prevent distortion. After the first milling operation, two holes are drilled and reamed in the flanges for locating the blocks in all future operations.

In another similar milling operation, the tops and sides are machined for both the valve cover plates and the manifolds. The ends also are surfaced by milling in another machine. Then the blocks are tested for hardness on a Rockwell machine, as in Fig. 2. The testing machine is on the conveyor line, so that no lifting is necessary, and the time required is almost negligible.

Farther down the line are two milling machines with side heads, one having the heads on an angle as at *A* and *B*, Fig. 3. The angular heads permit the milling of pads set at an angle on each side of the block, the block being located on the table *C* by suitable dowels. The table is stationary and the cutters are fed into the work. The second machine mills the regular pads on one side. The use of conveyors between the machines makes it easy to keep the work flowing down the line with no lifting of cylinder blocks.

The main drilling operation on the cylinder block is shown in Fig. 4, where the three heads are at work at the same time. The ends have been drilled previously. This illustration shows the way in which the fixture almost incloses the block, and also the steel strips on which it is slid into the fixture. The block is raised and then lowered over the locating pin, and is clamped in position by suitable mechanisms.

Stud holes are tapped while the block is held in the trunnion fixture shown in Fig. 5. As will be seen, the tapping spindles are set at different heights to reach holes in various parts of the block, as it is turned to other positions in the fixture. The fixture can also be moved back and forth so as to reach all the holes.

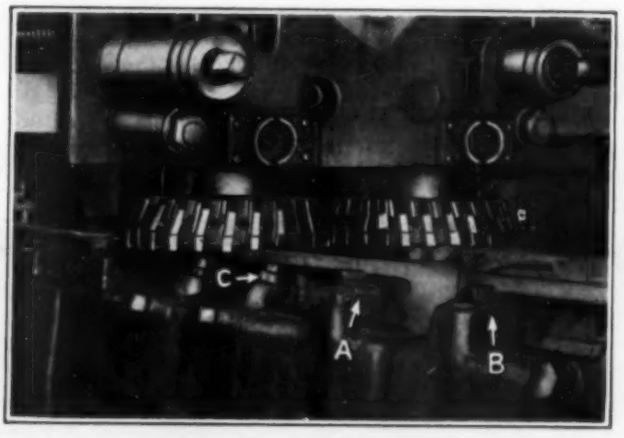
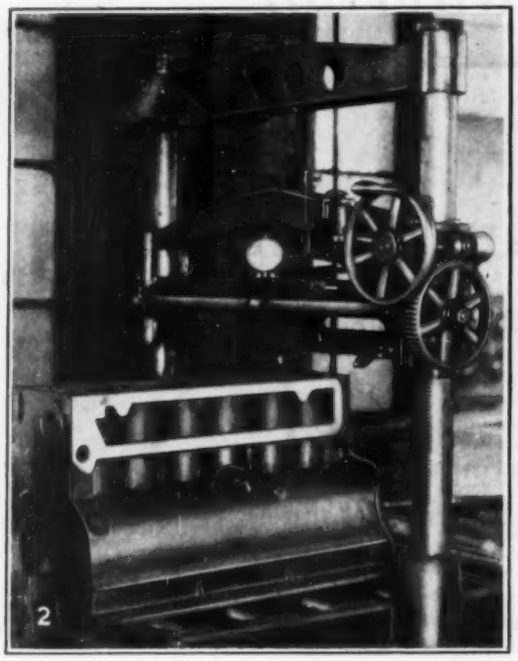


Fig. 1—Milling the joint face

For boring the crank and camshaft holes, the unusual fixture shown in Fig. 6 is used. Here the block is held upside down and at an angle. The block is swung over from the conveyor line by the hoist at *A* to the blocks *B*. It is then slid into the fixture, and the holding part of the fixture *C* raised so as to bring the block in position on the locating pins. The equalizing bar attached to the hoist is shown at *D*. The hoist is operated by air.

The lifting arms and the equalizing bar are shown more clearly in Fig. 7, which also shows the cutters used for roughing and finishing the crank and camshaft bores. Then too, there is the cross-boring head at *A*, by which a hole is bored in the side. This boring head

Automotive Production



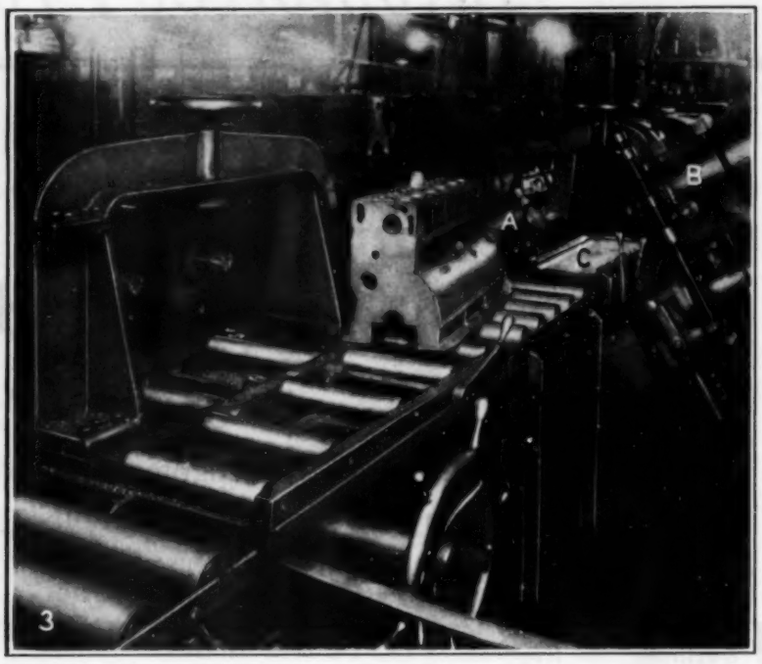


Fig. 2—Testing for hardness. Fig. 3—Two special milling machines

is driven by the shaft *B* while the head itself is moved in and out by the pilot wheel *C*.

One of the minor operations worth noting is the pressing in of the valve guides, is in Fig. 8. The guides are placed in the plate *A*, which is then located on the cylinder head as shown. The driver *B* is placed in the first guide and pressure applied to the air cylinder that controls the ram of the press. The block is slid along to bring one guide after another under the press, until all twelve guides have been pressed in place.

Continuing with the cylinder block on its way through the assembling department, it undergoes several further operations, in which grinding plays a large part. After the rear engine-support has been bolted into place, as at *A*, Fig. 9, the end surface is ground to receive the transmission case. The cylinder block is located by dowels and clamped down by the levers *B*. The clamps are quick acting, since the bolts are held

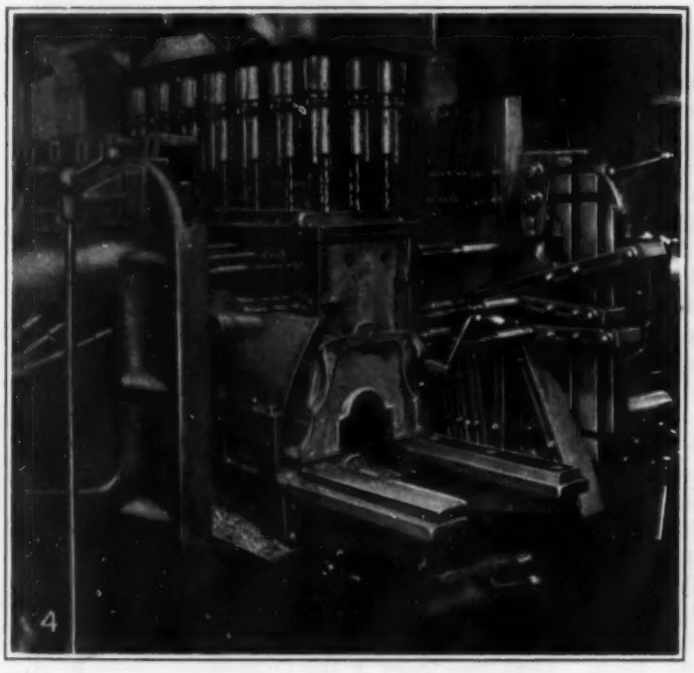


Fig. 4—Drilling three sides at once. Fig. 5—Tapping in trunnion fixture

Automotive Production

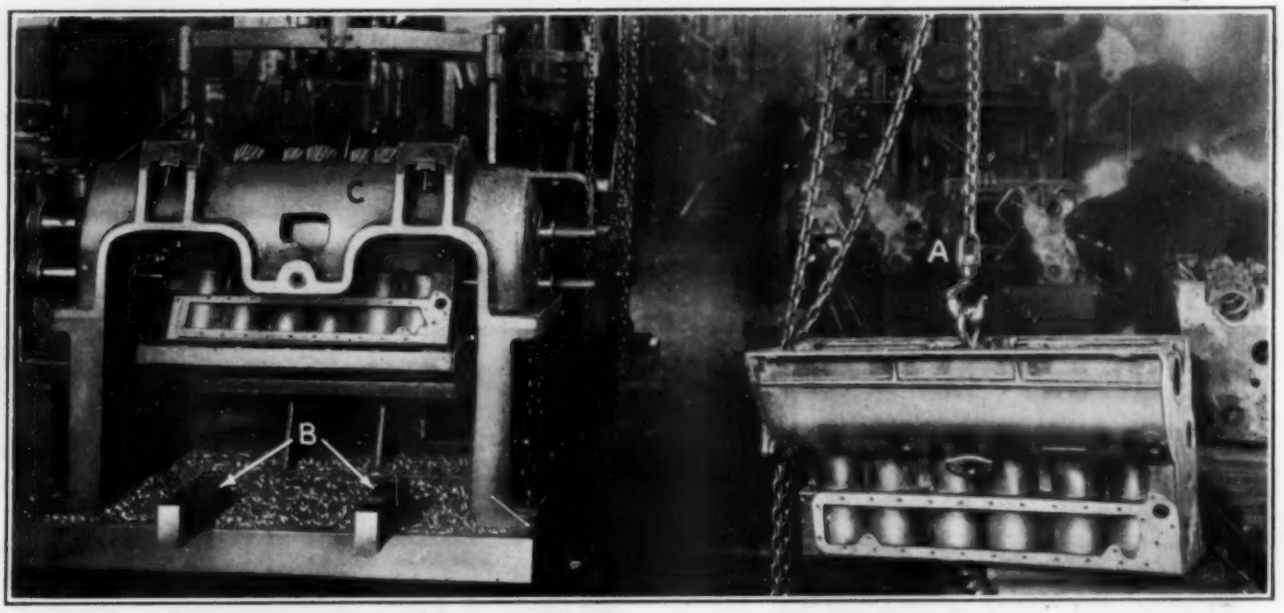


Fig. 6—Boring crank and camshaft hole

in place by bayonet joints on the lower ends, as at *A*, Fig. 10. The two views, Figs. 9 and 10, show the fixture both empty and loaded, and they also show the holder for the truing diamond. The machine is a Diamond grinder and is equipped with a ring wheel of rather large diameter.

Another and unusual grinding operation is shown in Fig. 11. The upper halves of the crankshaft bearings have been put in place and the edges are being ground flush with the bearing-cap seats, by the special grinding head in the overhanging arm. The block is easily clamped in position. The joint surface is protected by the covers *A* and *B*, which reach down inside the case. The wheel also is completely guarded.

In order to assure alignment of the transmission and the crankshaft bearings, the end of the support and

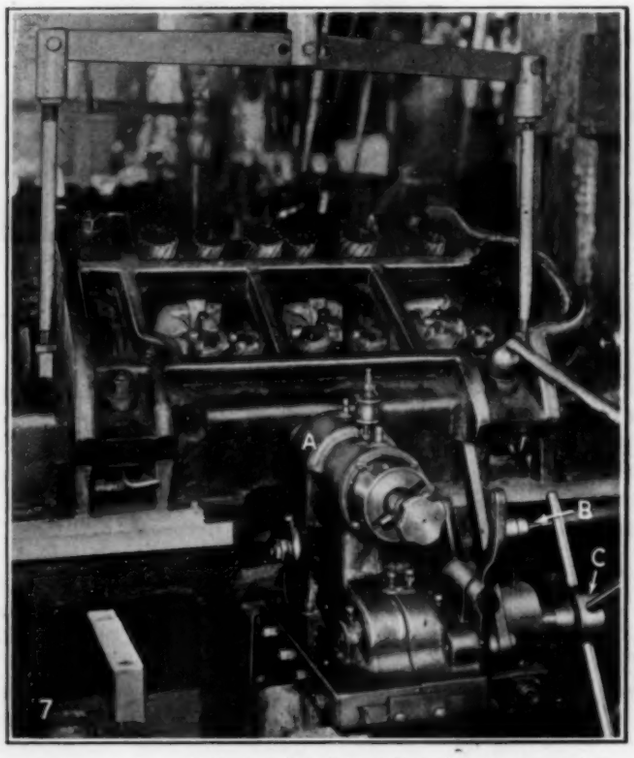


Fig. 7—Boring side hole at same time.

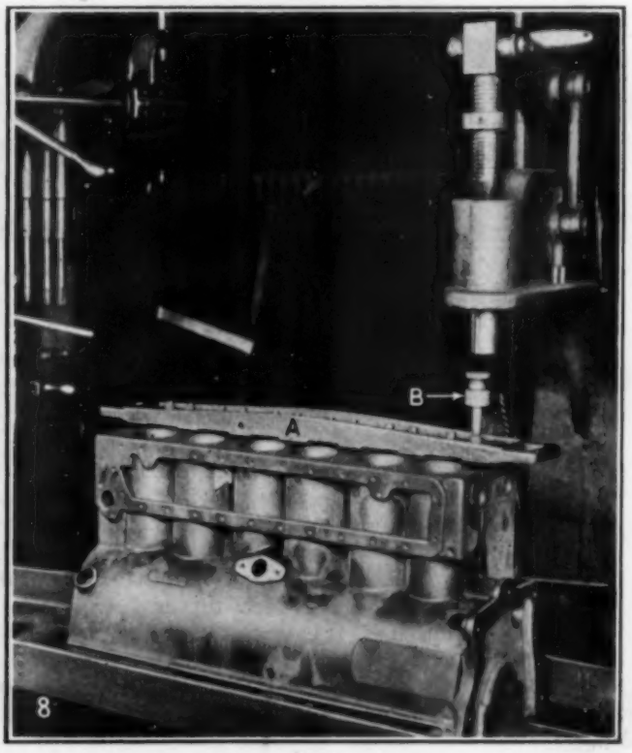
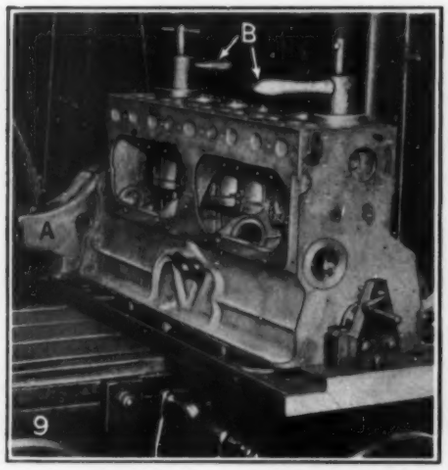


Fig. 8—Forcing valve guides in place

Automotive Production



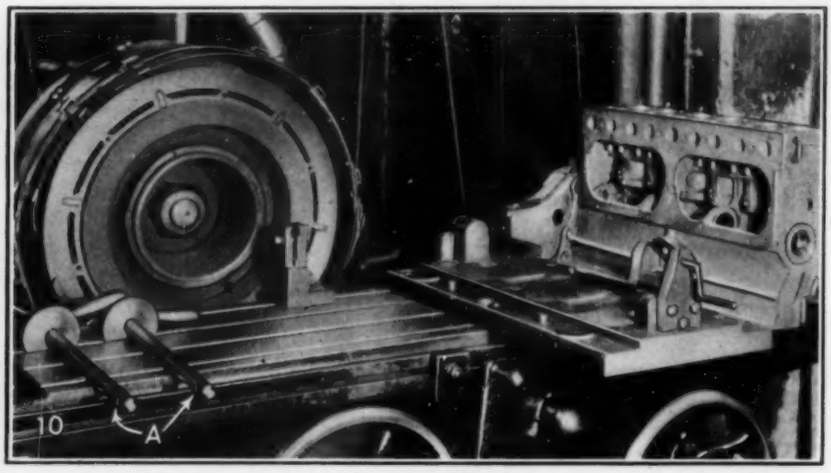
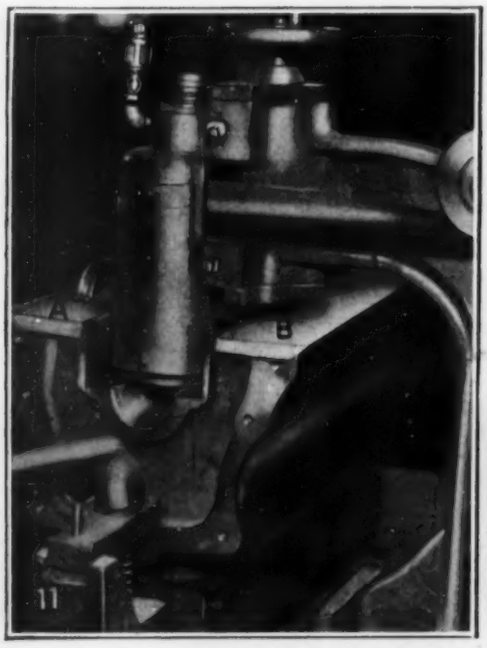


Fig. 9—Grinding end of housing. Fig. 10—Grinding fixtures



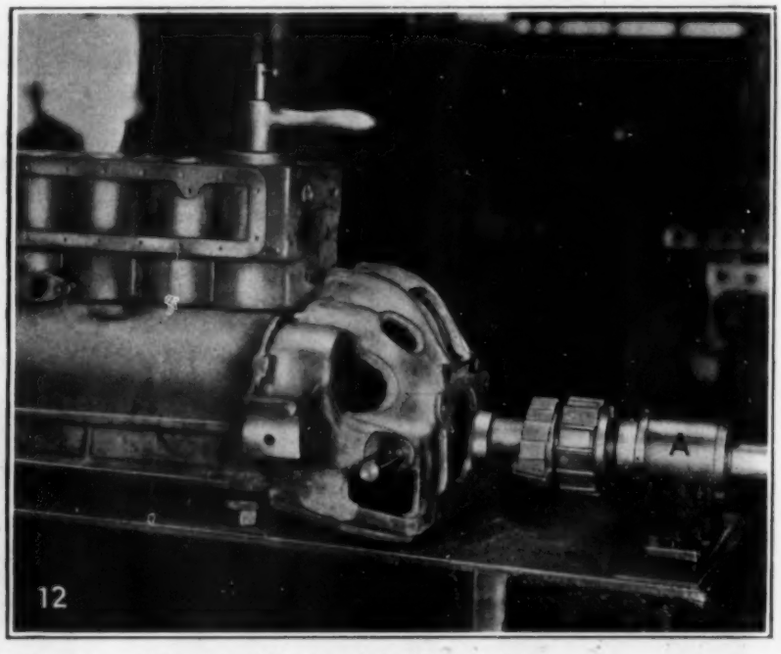


Fig. 11—Surfacing bearing caps. Fig. 12—Aligning holes in housing

housing is reamed after it is in place, as in Fig. 12. The block is located by the usual dowels, in line with the boring bar, supported by the substantial bearing at *A*. The same kind of clamping bolts are used as in the previous operations.

In several of the views a tag is shown attached to the cylinder block. The tags are in reality a series, or book of tags, one for each operation. As the cylinder passes through each stage of its progress, the operator removes the tag, as evidence of having completed that operation. The tags are turned into the cost department, and make it easy to keep track of the work actually performed.

The cylinder bores are finished by the honing process, whereby 0.002 in. of stock is removed. The hones are of conventional design, carrying six stones of 120 grit, and are driven by a specially-designed head, into which an automatic, positive-ratchet adjustment is incorporated.

It will be noted that several of the operations on these cylinders differ materially from those previously shown. Some are the result of the special design of cylinder block, and others because of the difference in method deemed best to solve the problem presented. It is these differences as to methods and fixtures that make it interesting and instructive to study the practices of the different automobile plants. The ability to devise methods to handle new designs or to utilize present equipment is largely responsible for the low machinery costs now possible.

The profitable use of existing equipment by the Hupp Motor Car Co. is an indication of the wisdom of not retooling for new models until it has been demonstrated that no major changes are likely to be made.

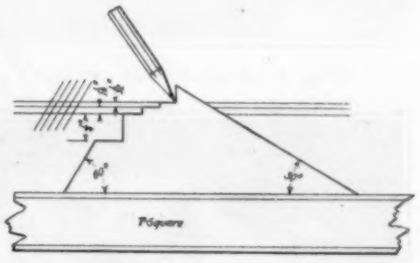
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Triangle Altered for Lettering

BY ARTHUR R. MYERS

In lettering drawings, it is necessary to draw guide lines so that the letters will be of uniform height. In order to standardize the guide lines I cut a series of steps in a 30-60-deg. triangle, as shown in the illustration. The steps were, respectively, $\frac{3}{32}$, $\frac{1}{8}$ and $\frac{1}{4}$ in., the last named to be used for titles consisting of capital letters only. In operation, the triangle is slid along the T-square with the pencil, the latter having been placed in the proper step. It will be seen that the guide lines can thus be drawn without previous measurement, and that the letters on all the drawings will be of the same height.



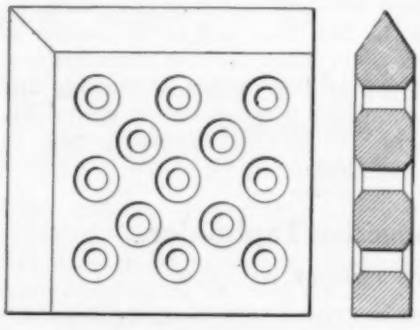
The altered triangle

The 60-deg. side of the triangle is used for drawing the guide lines that determine the slope of the letters.

A Handy Squaring Tool

BY CHAS. DOESCHER

The sketch shows a handy and convenient tool for tool and diemakers. One of the features of the tool is that it takes the place of a square for squaring up work in a shaper, milling machine, drill press, etc. Another feature is that the sharp edges make an A-1 straightedge. A square is a tool that has to be handled with care, for if it is dropped on the floor, or something is dropped on it, the blade is apt to be sprung out of square with the beam, with the result that it will have to be sent back to the factory to be reset.



A handy squaring tool

While the tool shown herewith cannot perform all the functions of a square, yet it does take the place of a square in many instances, and will stand the "gaff" since it does not have to be handled as carefully as a square.

It can be made in any desired size. It is hardened, and ground all over, and all four sides are square with each other. The $\frac{1}{4}$-in. countersunk holes are put in to lighten it.

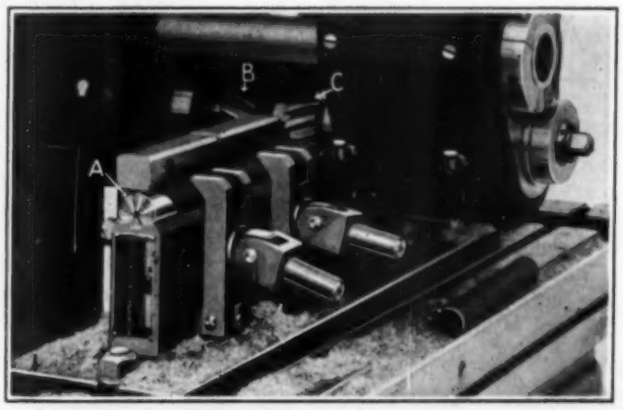
It makes a valuable addition to any mechanic's tool kit.

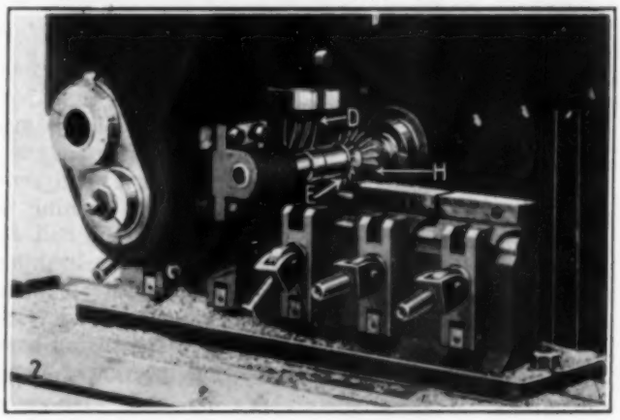
Fixture for Milling Steering-Column Nuts

BY G. L. ERWIN, JR.

The illustrations show a fixture and a special, opposed head which we had fitted to a No. 2B Milwaukee universal milling machine for milling five surfaces at one pass on bronze, steering-column nuts.

Five nuts at a time were located on the half-round bar *A*, Fig. 1, and were held in position by eccentrically-operated clamps.





Figs. 1 and 2—How the nuts were milled

The sides of the nuts were milled by the two spiral end-mills *B* and *C*, held on horizontal arbors in the opposed heads. The tops were milled by the spiral end-mill *D*, Fig. 2, mounted on the vertical spindle. The two corners were chamfered by the angular cutters *E* and *H*, held on a horizontal arbor.

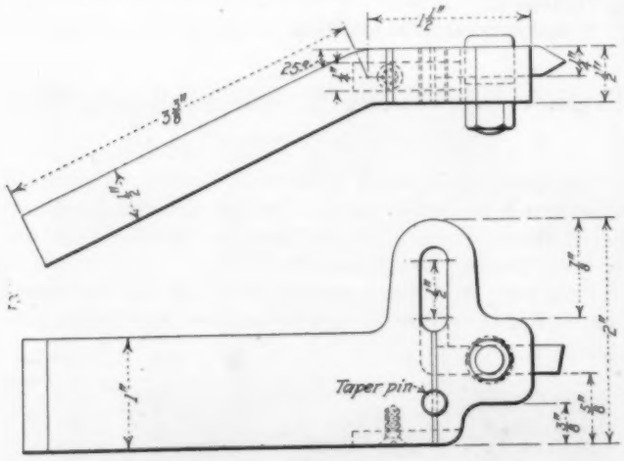
The feed was 9 in. per min. and the speed of the cutters 200 r.p.m. The nuts were milled at the rate of 72 per hour.

Home-Made Holder for a Threading Tool

BY BEN WEST

The toolmaker or machinist who is a real mechanic takes a good deal of pride in his kit of tools, many of the components of which may have been made by himself and after his own ideas. Such tools are usually well made, nicely polished and well taken care of, so that they are things of beauty as well as utility.

The spring threading tool shown in the accompanying sketch is an example, many of them having been



Spring holder for threading tool

made by the men and boys in our shop. This tool is a great help in cutting smooth, accurate threads, or it may be used to hold radius and other forming tools, up to a reasonable size.

The drawing gives all the data necessary to make the tool. With the taper pin fitted to place as shown, the tool is rigid. With the pin removed it is a spring holder.

Pressing In and Reaming Piston Bushings

BY CLIFFORD H. FRENCH

Two ingenious operations on pistons in the factory of the Cleveland Automobile Co., interested me the other day. One was the way in which the pin bushings are pressed into the pistons, and is shown in Fig. 1.

A piston is slipped over the projection *A*, and centered loosely on the shoulder *B*. Then the bushing is put on the plunger *C* where it is held by the ball *D*, which has a light spring behind it. With the bushing held in place, the operator presses down the plunger and forces it home, frequently shaving something from the outside as indicated by the chips. The piston boss rests on the support *A*, and is thus prevented from springing.

After the bushings are in place they are reamed in

Fig. 1—Fixture for pressing in bushings

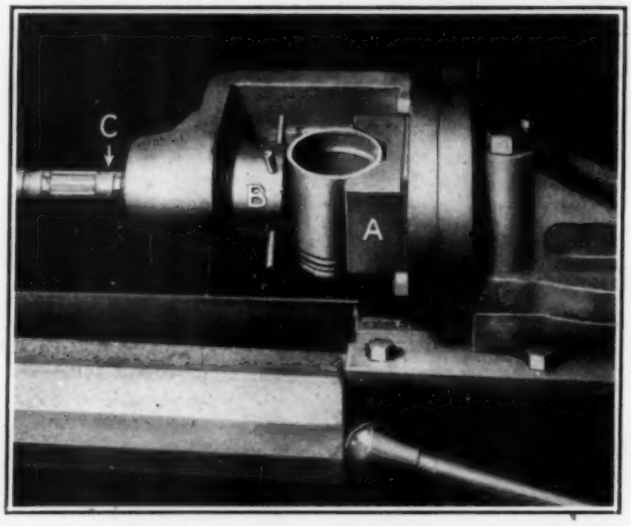


Fig. 2—Reaming the bushings

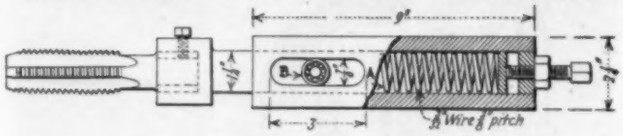
the fixture shown in Fig. 2. The piston is centered in the V-block *A*, and is held lightly by the capstan screw *B*. The capstan screw is hollow, and acts as a guide for the floating reamer *C*. The front end of the reamer is also guided through the V-block and the main casting, as the piston is fed over the reamer by moving the turret slide forward. Care is taken not to spring the piston with the screw *B*, it being necessary only to hold the piston in the block.

A Sensitive Tapholder

BY FREDERICK WILHELM

While using Hanson ground taps in an ordinary tapholder in a turret lathe, I encountered some difficulty in keeping the threaded holes to standard, owing to the drag of the turret. I then made the sensitive tapholder shown in the illustration, and have had no further trouble.

With the machine stopped, the tap is brought up against the work. The machine is then started, the tap being forced forward by the pressure of the spring *A*, which allows it to start quickly, follow its normal pitch,



Sensitive tapholder

and cut standard-sized threads. The spring pressure is regulated according to the size and pitch of the tap.

Ball bearings, as at *B*, are used in the slots to minimize the friction in sliding, due to the twisting action of the cut, and allow the tap to move freely in an axial direction.

The holder has been used with success with taps varying from ⅜ to 1¾ in., having pitches from 11 to 24 per inch.

Knurl Holder for Automatic Screw Machine

BY LEO FELTEN

The knurl holder we formerly used on Brown & Sharpe automatics is shown in Fig. 1. The trouble with this holder is that in order to adjust the knurl, it is necessary to loosen the clamping bolt that holds the form tool, making it necessary to reset the tool.

To obviate this difficulty, I designed the holder shown in Fig. 2. The body of the holder is made in two parts,

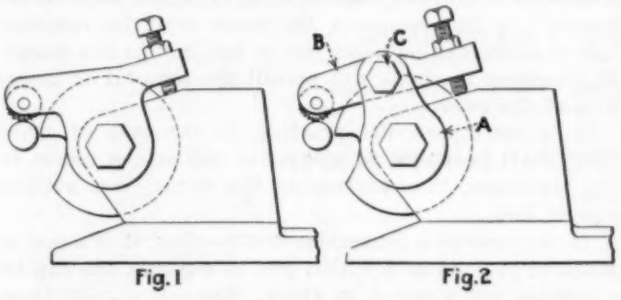


Fig. 1—The holder formerly used. Fig. 2—The improved holder

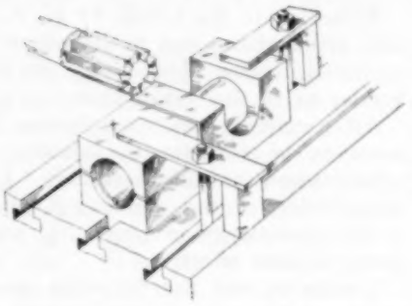
the support *A* and the adjustable arm *B*. With this holder, the knurl can be adjusted by loosening the clamping bolt *C*, making it unnecessary to loosen the bolt that holds the form tool.

How Would You Do This Job?—Discussion

BY H. K. WHITE

The question propounded by Henry Densmore on page 904, Vol. 63, of the *American Machinist*, is certainly no easy one to answer. While there may be many ways of cutting in the side wall of a steel tube, a hole that is almost equal in diameter to the inside diameter of the tube itself, none of them are very rapid, and probably few would answer the question as a commercial proposition.

I would suggest that a fixture, similar in principle to the one I have sketched, be made to go on the table of the milling machine. It should be tongued to the center slot and fastened down by any suitable means. A portion of the fixture should be made in a manner that will allow it to clamp the tube firmly and hold it for the operation. The fixture, with the tube in place, is then fed straight toward an end mill held in the spindle of the machine, the cross-feed screw being available for the purpose. The resulting hole might not be quite round, but it would be near enough for all practical purposes, and if more than ordinary accuracy were required, the tubes could be put through a secondary reaming operation to round up and size the hole.



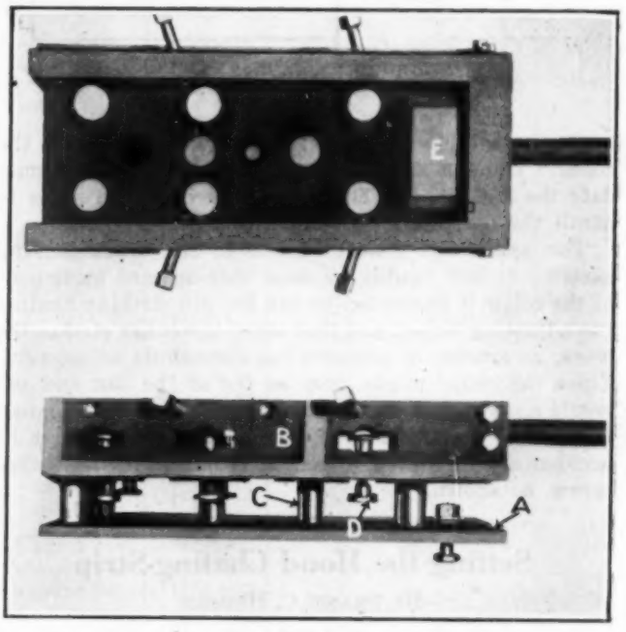
Milling hole in side of shell

Fixture for Machining Shoes and Wedges

BY J. H. HAHN

The illustration shows a plan view and a side elevation of a fixture used in machining shoes and wedges after they have been laid off in position in the jaws.

The fixture consists of the base *A* and the body *B*, the body being raised above the base and supported by posts, as at *C*. The reason for the space between the base and the body, is to allow room for the operation



Shoe and wedge fixture

of the leveling jacks *D*. The setscrews for holding the work are set at an angle, so as to force the work against the stop *E*.

The fixture can be used on a planer or shaper and will accommodate the shoes and wedges of twelve classes of locomotives, from the small, simple ones, to the 2-8-8-2 type Mallet compounds.

A Lute for Babbitting Bearings—Discussion

By H. K. Griggs

Referring to the article by H. R. Fowler, under the title given above, and published on page 607, Vol. 64, of the *American Machinist*, I do not agree with Mr. Fowler as to the use of asbestos.

After making some experiments, I have found magnesia to be superior to asbestos, since it is more adhesive and contains more fiber. I pulverize old magnesia boiler lagging, and mix it with boiled linseed oil to the consistency of putty. If warmed slightly, the putty is more effective.

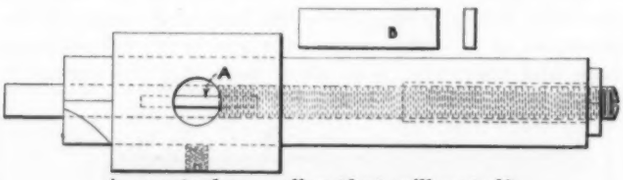
I wish to add the following caution: After babbitting a bearing, do not attempt to remove the hot putty with the bare fingers. Use a stick, and you will avoid burning your fingers. Novices generally learn this lesson from actual experience.

A Stop Collar for the Counterbore

By H. Moore
Montreal, Canada

Nearly all the stop collars for counterbores that I have seen are either clumsy to adjust, or else they have had a tendency to slip when brought against the work.

In the tool shown in the accompanying sketch, the pilot hole in the body is drilled clear through and the



A counterbore collar that will not slip

upper part is tapped for the screw that adjusts the collar. The slot *A* is put through the body to accommodate the flat pin *B*. The stop collar is drilled so as to admit the flat pin.

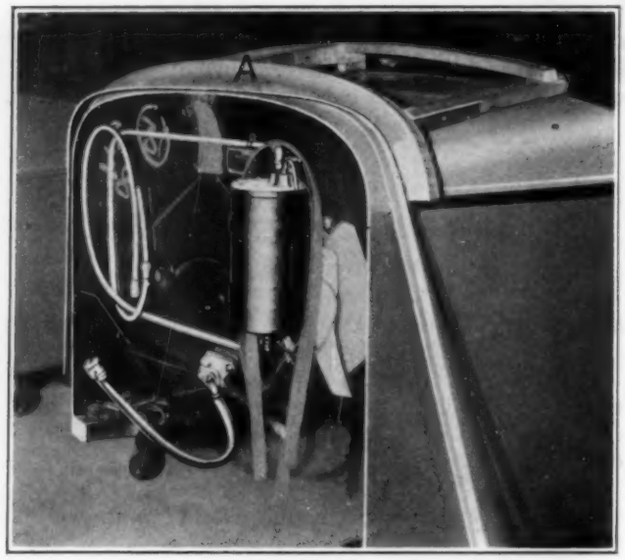
The assembled tool is shown in the accompanying sketch. It will readily be seen that upward movement of the collar is prevented by the flat pin striking against the adjusting screw, and that when the collar strikes the work, no amount of pressure can disturb its adjustment. Since the collar might drop as far as the slot and pin would allow, a headless setscrew is put in to bear against the body. To make sure the adjustment will not be accidentally disturbed, a locknut is put on the adjusting screw, as shown.

Setting the Hood Chafing-Strip

By Frank C. Hudson

Frequently the small details of motor-car work take more time than they should. The illustration shows how the Cleveland Automobile Co. saves time in putting the chafing strip for the hood on the cowl of the body. The strip is made of aluminum, and one edge is rolled into a bead, the bead breaking the line between the hood and the cowl.

The fixture is a wooden frame, *A*, having soft pads on the bottom to prevent marking the cowl. It is simply laid on the cowl and spaces the strip from the windshield. In this way the strip is quickly and accurately located while being riveted to the cowl.



Locating the hood strip on the cowl

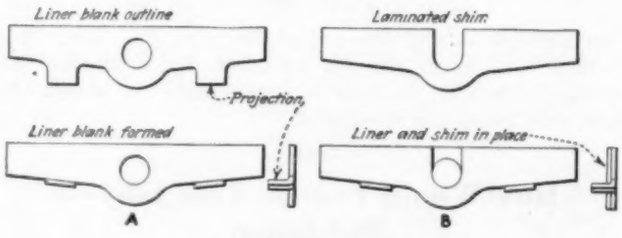
How to Fit Shims in Bearings—Discussion

By James McIntosh

In an article by George G. McVickers, under the title given above, published on page 724, Vol. 64, of the *American Machinist*, two designs of shims were illustrated. In the design *A* the bolts must be removed before shims can be taken out or put in. In the design *B*, loosening the bolts will permit the removal or insertion of the shim.

It is sometimes the practice, in the case of main crankshaft bearings, to spigot the cap into a recess in the crankcase, thus preventing the shims from getting out of line.

In the case of a connecting-rod bearing, it is usual to machine the rod as a whole, and to separate the cap by a slitting saw about $\frac{1}{16}$ in. thick. Suppose a $\frac{1}{32}$-in. liner is made as at *A*, with projections formed on the outer



Liners for keeping shims in place

edge to retain the shims, which may be removed or inserted by dropping the cap an amount equal to the depth of the projections on the liner. The liner, of course, need not be removed when adjusting the bearing.

The liner can be made of steel to make it more serviceable. The fact that it does not come in contact with the crankpin, being held in place by the bolt and the projections, would make its use a satisfactory means of simplifying either the adjustment of the bearings or the assembling of the engine.

Heat-Treatment for Nickel Steels

There are steels on the market with a low nickel content used almost entirely for carburizing purposes. They are substituted for plain carbon steels because of the greater hardening power of the case, and can be used with a less expensive heat-treatment than is permissible with straight carbon steel.

Nickel steels of higher nickel content than 1½ per cent are generally standardized at 3½ per cent. They are used in the low carbon content for carburizing purposes, and are intended for important case-hardening work.

The process of carburizing recommended for nickel steels is the pack method. The time required for carburizing will depend upon the depth of the case, which is governed by the work to which the piece will be subjected. A general rule for gears is to have a case on each side of the tooth about 15 per cent of the thickness of the tooth.

Removing of the parts from the box at a high temperature is likely to cause distortion. A low carburizing temperature should be used; or, after cooling, the parts should be reheated to the carburizing temperature to refine the core. The temperature for hardening the case should be as low as possible. The tempering temperature for all classes is between 250 and 450 deg. F. on all of these steels.

For the 2100 class of steels with carbon content from 0.10 to 0.25 per cent, the same heat-treatments may be used as for straight carbon steel of the same carbon content. But if the nickel content is as high as 1.5 per cent, the quenching temperature may be about 25 deg. F. lower. On gears and other parts where a minimum of distortion is required, this steel should be given a normalizing treatment.

The 2315 steel is used where ductility is necessary, while the 2320 class is recommended for parts of large cross-section where core hardness and strength are required. The 2315 and 2320 steels are used for important parts requiring case hardening.

The low-carbon content nickel-chrome steels, with from 0.10 to 0.25 per cent of carbon, are used for carburizing purposes. Those with carbon content as high as 0.20 per cent are recommended only for case-hardening in massive parts, since the higher carbon will make a brittle core unless carefully heat-treated.

For annealing nickel steels for machining purposes, the parts should be placed in the furnace to expose a maximum surface area, and brought slowly and uniformly to a temperature of 1,600 deg. F. The 5 per cent nickel steel should be held at this temperature for about an hour, and then cooled in the furnace, allowing from 5 to 8 hours for the cooling.

Treatment for Carburizing and Hardening Nickel Steels

S.A.E. Steel No.	Purpose of Heat Treatment	Carburize at Degs. F.	Cooling Method	Reheat to Degs. F.	Quench	Reheat to Degs. F.	Quench
2115–2120	For important parts	1650–1700	Water or oil				
2115–2120	Max. hard case; medium ductile core; distortion not important	1650–1700	Oil	1375–1425	Oil or water		
2315–2320		1600–1650	Oil	1325–1375	Oil or water		
2512		1600–1650	Oil	1300–1350	Oil		
3115–3120		1625–1675	Oil	1375–1425	Oil or water		
3215–3220		1625–1675	Oil	1375–1425	Oil		
3312		1600–1650	Oil	1375–1425	Oil		
3415		1600–1650	Oil	1350–1375	Oil		
2115–2120	Max. hard case; refined and ductile core; distortion not important	1650–1700	Oil	1625–1675	Oil	1375–1425	Oil or water
2315–2320		1600–1650	Oil	1500–1550	Oil	1325–1375	Oil or water
2512		1600–1650	Oil	1475–1525	Oil	1300–1350	Oil
3115–3120		1625–1675	Oil	1525–1575	Oil	1375–1425	Oil or water
3215–3220		1625–1675	Oil	1525–1575	Oil	1375–1425	Oil
3312		1600–1650	Oil	1475–1525	Oil	1375–1425	Oil
3415		1600–1650	Oil	1500–1550	Oil	1350–1400	
2115–2120	Hard and refined case with minimum distortion	1625–1675	Cool in box	1375–1425	Oil or water		
2315–2320		1575–1625	Cool in box	1325–1375	Oil		
2512		1600–1650	Cool in box	1300–1350	Oil		
3115–3120		1628–1675	Cool in box	1375–1425	Oil		
3215–3220		1625–1675	Cool in box	1375–1425	Oil		
3312		1600–1650	Cool in box	1375–1425	Oil		
3415		1600–1650	Cool in box	1380–1400	Oil		
2115–2120	Hard case; refined core; strongest condition with min. distortion	1625–1675	Cool in box	1600–1650	Oil		
2315–2320		1575–1625	Cool in box	1475–1800	Oil		
2512		1575–1625	Cool in box	1425–1450	Oil		
3415		1575–1625	Cool in box	1450–1475	Oil		
2115–2120	Hard and refined case; max. ductility of core with min. distortion	1650–1700	Cool in box	1625–1675	Oil	1375–1425	Oil or water
2315–2320		1600–1650	Cool in box	1500–1550	Oil	1325–1375	Oil
2512		1600–1650	Cool in box	1475–1525	Oil	1300–1350	
3115–2120		1625–1675	Cool in box	1525–1575	Oil	1375–1425	Oil
3215–3220		1625–1675	Cool in box	1525–1575	Oil	1375–1425	Oil
3312		1600–1650	Cool in box	1525–1575	Oil	1375–1425	Oil
3415		1600–1680	Cool in box	1500–1550	Oil	1350–1400	Oil

For the information given we are indebted to the A.S.S.T.

© American Machinist

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Fitting a Spherical Surface

Q. We have a job of fitting a ball into a spherical depression in a steel block. The diameter at the mouth of the depression is 2½ in., and the depth is ¾ in. What should be the size of the ball to make an exact fit in the depression?

A. You can assume the diameter of the mouth of the depression as the chord of an arc having a height equal to the diameter of the depression. Then use the formula:

$$\text{diam.} = \frac{\frac{1}{2}\,\text{chord}^2 + \text{height}^2}{\text{height}}$$

This will give $\frac{1.6819 + 0.5625}{0.75}$, or 2.9925 in. diameter of ball. It is very probable that a 3-in. ball was intended to be fitted into the depression, and that you have made a slight error in measuring the diameter. We would suggest making the ball 3 in. in diameter, and seating it snugly by lapping in with fine abrasive and oil.

Bluing Steel Parts—Discussion

BY ARTHUR F. PARKER

I was pleased to see the description of bluing steel parts on page 61, Vol. 64, of the *American Machinist*. The knowledge of bluing steel seems to have been kept from the trade by the "secret process" method so long in vogue, that I am glad to add the following method which we use successfully in the manufacture of telescopic and metallic rifle sights and other gun parts and accessories.

The method outlined by you gives a good blue, but does not give a dull, dead black finish such as is desirable on rifle parts to avoid reflection of light. By the method here given a dull black is obtained, which is very satisfactory and inexpensive.

Prepare a solution of one part nitric acid to seven parts of water in an earthenware vessel large enough for the parts to be treated. Before treating the parts, have them free from oil and finger prints but not necessarily highly polished. Attach a piece of iron wire or any other holding fixture to the parts and immerse in the acid solution for three or four minutes, keeping parts slowly moving to make sure that all surfaces are reached by the acid solution. Withdraw and plunge in boiling soda water for five minutes to kill the acid action. Then immerse in clear hot water for fifteen or twenty minutes. Do not slight these two boilings or streaking and spotting will result.

Next, be sure that all parts are dry, and immerse in a mixture of sixteen parts by weight of either sodium or potassium nitrate (saltpeter) to one part black manganese dioxide, heated to 800 deg. F. and leave them in for four minutes. Withdraw and plunge again into boiling soda water for five minutes, then into clear boiling water for fifteen or twenty minutes. Allow the parts to dry and apply linseed oil with clean woolen rags.

In the absence of heat recording instruments to get the temperature of the niter bath, apply heat until the mixture will flash wood sawdust when sprinkled on the surface. This bath is rather severe on cast-iron or steel pots and a nickel-chromium pot is much more satisfactory. As the manganese dioxide adheres to the parts immersed, more of it must be added to the mixture occasionally to preserve the strength.

Recasting Aluminum

Q. Can you tell us how to flux old aluminum crank cases to get clean and clear aluminum castings?

A. Pure aluminum is unsuitable for castings, and is never employed alone for the purpose. "Aluminum" crank cases are made from alloys containing copper or zinc, or both, and the proportions vary with different makers. A small percentage of iron is also included. Your first difficulty is in obtaining a uniform mixture, and the different alloys cannot be mixed and run at one uniform temperature with good results. Moreover, if you are die-casting, you will need a different alloy than that used for casting in sand.

Aluminum alloys must be handled with a knowledge of their constituents. Aluminum has a tendency to lather like soapy water if not poured with care. In making the alloys the aluminum is first melted, and the alloying metal is then added. When the aluminum alloy castings are remelted it is very difficult to prevent oxidation of the aluminum, and the castings made from scrap, therefore, are brittle and unsound.

Commercial aluminum alloy castings are likely to contain in varying proportions one or several of the following metals: copper, zinc, tin, manganese, magnesium, and iron. The selection of alloying metals is made to suit the requirements of the cast parts. It is almost impossible to control the castings made from remelted scrap. If the castings which you are making do not require to be uniform in strength and quality, you might employ a percentage of scrap, but all-scrap castings are not usually recommended.

Loss of Air Pressure—Discussion

BY Z. W. WICKS

In the answer to the question on loss of air pressure in a compressed air system, on page 874, Vol. 64, of the *American Machinist*, I believe that two important causes of loss of pressure are overlooked. The underground line may not be tight, and the air may be leaking into the ground. It should be tested for airtightness in the line. The second cause is that the line may have water in it. The line should be blown down from its lowest point every day to remove the water. This should be done in the morning as soon as pressure is built up.

Technical Abstracts

Foremen and Psychology

To many foremen, psychology savors of an unknown science, something deep and mysterious, but this is not so. Psychology is nothing but a study of the behavior of human beings under the conditions of heredity and environment. A good executive must use psychology every day to accomplish his desires with the greatest ease. Men should be encouraged to talk to the foreman, who can possibly correct the source of difficulty. An executive should cultivate the confidence of his men so they will know he is sincere in his desire to help them. Suggestions from the men on the machines or bench should be sought by the foremen, for experience proves that many valuable improvements have come from those in continued intimate contact with detailed operations. These men frequently see the inconsistency or injustice of various shop rules and should feel free to discuss such things with their immediate superior. Frank D. Slutz, in *The Foremen's Magazine*, May, 1926, p. 7.

American Industrial Leadership

The reason for American leadership in industry is based on our production methods. If it were not for our co-ordination of machine and man power, our systematic development of work and our elimination of waste and utilization of by-products, we could not hope to maintain the high wage standards we do and manufacture goods at a price which enables us to compete in foreign markets, as well as to supply our own people with goods at the present market price.

The most outstanding industry in this country in which production methods have been highly developed, is the automobile industry. Behind this industry has been capital that has been willing to take a risk; invariably a resourceful management; the willingness to pay the proper reward to the inventor; and, lastly, perhaps the most important of all, the proper spirit of labor in accepting newly developed equipment and making use of all labor-saving devices to secure the greatest possible production of quality products.

Production methods have been made possible in this country because the buying public in the United States is willing to accept a standardized product.—*Fuels and Furnaces*, May, 1926, p. 527.

Standardization of Drawings

The size of drawings in Germany has been standardized. A standardization of drawing apparatus is now also demanded. In this connection inclined drawing boards are condemned as bad for the health of the draftsman, as not very convenient to look over and as occupying too much space. Standing boards are demanded and the drafting machine is held to be very desirable, although not indispensable. A detail discussion of dividers, drawing pens, etc., leaves the impression that many recent refinements on these things should be regarded as frills which very well could be dispensed with in the interest of durability and simplicity. A blueprint paper has now made its appearance which is used dry and hence saves the long and tedious drying period of the old time wet paper. C. W. Hofman in *Maschinenbau*, April 15, p. 359.

Tool Steel

Not many years ago tool steels were purchased almost entirely by the brand name. Little mention was made of analysis. The customer placed his order for a given brand for a certain purpose and left the specifications to the steel maker. It is becoming the practice, especially with large users, to order tool steel to their own specifications, rather than by the manufacturer's brand name.

A typical specification covering hot-rolled high-speed steel for general purposes states that the material desired is an annealed 18-4-1 type high speed steel which will respond to hardening and tempering suitable for high speed cutting tools. The steel shall be made by the crucible or the cold-melt electric-furnace process. It shall be commercially free from segregation occluded oxides, slag and other impurities as determined by micro- and macro-analyses; the surface decarburization shall be kept at a minimum; the bars or shapes shall be as straight from end to end and as smooth and free from flaws such as pits, slivers, seams, cracks, dents, and soft or hard spots as good commercial practice will allow; the steel shall be delivered in the annealed condition suitable for machining. W. H. Wills, Jr., Atlas Steel Corporation, in *Transactions of the American Society for Steel Treating*, May, 1926, p. 755.

Environment of Workers

A survey of a particular foundry plant showed the following conditions: The light was poor, the building was erected 25 or 30 years ago and in all that time the windows had never been washed. The molders' benches were so located that what light did come through the dingy windows shone directly into the worker's eyes. To make matters worse an electric light, with no shade to protect the eyes, was suspended over each worker's bench in such a manner that he had to look directly at it in focusing his eyes on his work. The roof leaked and when it rained water dripped onto the men. The building had ventilators in the roof to carry off the smoke, dust and gases, but these ventilators were left closed so they did not function. Heating facilities were inadequate for winter, and poor ventilation made summer heat almost unbearable.

Everyone reacts consciously or subconsciously to his surroundings and his personal efficiency is affected to a greater or lesser degree by that environment. It is only recently that we are realizing that it makes a difference if a factory is dingy or bright, painted white or not painted at all. Modern factory construction takes into primary consideration the comfort of the workers because now we appreciate the intimate connection between physical well being and contentment. Glenn L. Gardiner in *Industrial Psychology*, May, 1926, p. 364.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Cost, Price and Service

PROFITEERING is supposed to be an inordinate or improper profit. But is profit to be based on the cost, or on the kind and length of service rendered? Is there any rational basis for determining what a proper profit really is?

Take as an example the holder and the blade of a safety razor. The holder may easily last a lifetime; a blade perhaps but a few days. Is the same margin of profit on each fair to either the maker or the user?

As another extreme take a large machine that has been on the market for years and in which the details have been very carefully worked out. Various parts have been improved and strengthened until the life of the machine is almost unlimited. Should the price of the machine be based solely on the cost plus the usual profit, or is it justifiable to charge a price based on the service it will render?

The improvements may remove any profit due to repair parts or replacements. On what should the price be based—cost or service?

Lower Turnover to Lower Costs

LOW labor turnover is a recognized advantage. With the cost of hiring and losing an employee running anywhere from $20 to $250, it is an important step when a mean job is changed into a delightful one.

In a railroad repair shop a machine was devised for grinding-in throttle valves and throttle-valve stand pipes. Three of each are ground at a time. By the hand method only one could be ground.

The foreman in charge of the job is proud of the machine. He speaks feelingly of the saving in time on the job. But with even more feeling he emphasizes the saving in labor turnover that has resulted. It was almost impossible to keep a man at hand grinding for any length of time. Now the operator likes the job and does other work while the grinding is going on.

Reduced labor turnover is one of the advantages of modern shop equipment. Power rapid traverse, power elevation, push-button control, air chucks, and other features that reduce the manual work of operation are as surely lowering production costs by reducing labor turnover as they are by turning out the work in less time.

Foreign or Domestic Markets

AN ANALYSIS of census figures by the National Industrial Conference Board seems to offer arguments for the manufacturers who contend that foreign markets are relatively so unimportant as compared with the United States that they are worth little effort. According to the analysis, the growth of the United States in the five years from 1920 to 1925, an increase of ten million people, or nearly four million gainfully occupied, or some five and a half billion in annual purchasing power, represents more in the way of markets than the acquisition of all of Canada or of Australia and New Zealand combined.

On the other hand, let us not forget that our productive capacity is growing at least as fast, and probably faster. Consequently, competition will force the manufacturer to look farther afield to keep his factory running full.

There is another angle to this thing that is worth the consideration of statesmen. Is it better to add to the markets of a nation by conquest or colonization or imperialism, call it what you please, or to stimulate healthy national growth based on sound business principles and sane industrial relations?

An Experiment in Psychology

QUICK-STEP or funeral march? By which time does the work move through the shop? In which tempo do the men perform?

A certain railroad repair shop has a shop band—a bang-up, A1 band. Each Monday noon it gives a concert in the shop. The closing air is always, quick, aggressive, inspiring. "That puts pep into you; I feel like I can fit an extra driving box this afternoon," one of the men was heard to remark after a particularly rousing program. And he did.

The master mechanic a week later had the leader select a funeral march for the closing number. What a contrast—the men dragged back to their work, faces were long all afternoon and output slumped seriously. There will not be another funeral march as a finale in that shop.

A band isn't necessarily required to influence the men toward greater output. There is a psychological effect as a result of rapidly moving materials that makes men want to keep them moving. Conveyors, power trucks, quick transfer of parts in process, high-speed machines and tools, all have that effect. A similar result is obtained by piling up plenty of work ahead of a man and removing it as soon as it is finished.

There is a great difference between a funeral march and a quick-step selection—and just as great a difference between the reactions of the human mind to them.

Shop Equipment News

Lehmann Oil-Groove Milling Machine

The machine shown in the accompanying illustration was designed by the Lehmann Machine Co., Chouteau and Grand Aves., St. Louis, Mo., primarily for railroad shop use, to mill oil grooves in crown brasses for locomotives, but it can readily be adapted to other work of a similar nature.

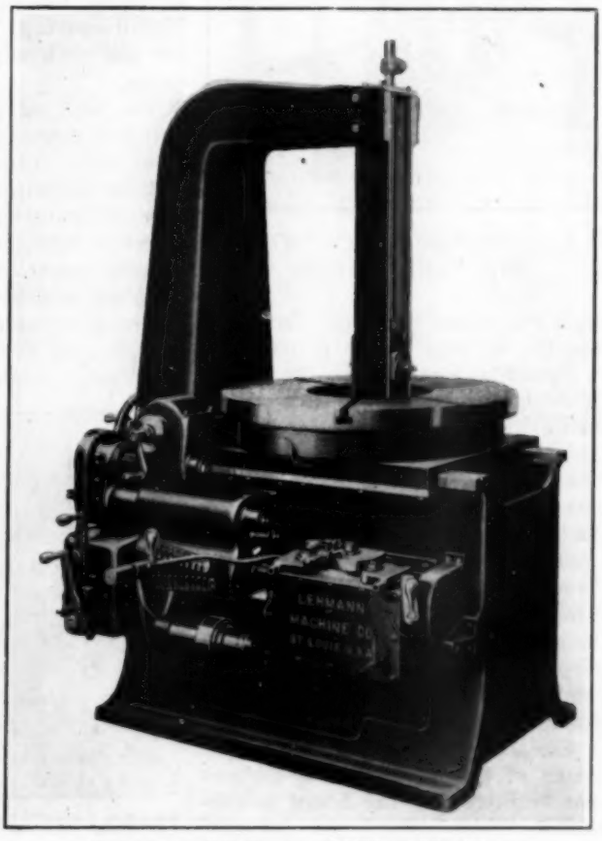
The machine is designed to cut two oil grooves in a crown brass parallel with the axis disposed at 45 deg. from the apex with two diagonal grooves connecting the one end of each parallel groove with the reverse end of the other, and it can cut the diagonal grooves deeper at the apex where the brass is thicker and likely to wear the most.

A head carrying a three-groove end mill of the desired size travels in the slides of the central vertical column. This column is rigidly secured at the bottom and is fastened at the top to the heavy main column which bridges over the back of the machine, forming a structure sufficiently rigid to withstand the requirements of the demands made upon it.

The table is provided with a device for holding the brasses in position and means are provided for easily determining the correct location. A lateral movement allows the cutter to be fed into the brass to the desired depth. The table has a rotary movement which co-ordinates with the vertical movement to cut the diagonal grooves. A feed box with forty quick changes of speed controls the rotary movement of the table, and this is provided with an index indicating the length of straight grooves to which the diagonal grooves are formed. The operator needs only to select the length of the straight grooves and to drop the plunger of the quick change mechanism into the hole which designates the dimension.

The control for the operation is by one handle which, when in a central position, gives a straight vertical movement to the head. When it is moved to the left it gives a left diagonal movement, when it is moved to the center again a vertical movement, and when moved to the right a right diagonal movement. Neutral positions are provided between all the feed positions of the handle.

Stops for both upper and lower position of the cutter are provided with a graduated index, and these are set before the operation for the length of slot desired, which relieves the operator from the necessity of throwing the control handle at precisely the right time. The feed of the cutter comes to a stop at the extremity of its movements until the control handle is thrown to its succeeding operative position. Various movements have handles for the manual operation or the independent power movement for obtaining setting-up positions.



Lehmann Oil-Groove Milling Machine

Provision is made for the disposal of chips to the inside of the machine base, which has an opening through which they may be removed. All working parts are protected from chips and the feed screw under the head is entirely inclosed by a telescopic cover. A 5-hp. motor is mounted on the back on the machine and drives through a silent chain which has an oil-retaining cover. A countershaft can be substituted for the motor when it is desired to have a belt drive. Two speeds are provided and two changes of feed. All gears are hardened or heat-treated. The shafts are of alloy steel and ball bearings are provided at many points. Its positive clutches are made from alloy steel, heat-treated. The gear boxes are inclosed and oil-retaining, except the quick-change box which has a central oiling reservoir. The worm and gear on the table run in an oil bath which provides lubrication to the table bearings.

The capacity of the machine is from 7 to 14 in. in diam. and up to 22 in. in length. The machine has a feed of cutter of 4 and 6 in. per min. The full depth can be cut at one time, and the relative depths of side and apex grooves can be selectively predetermined.

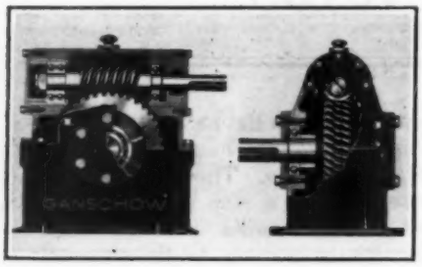
The weight of the machine and of the motor is about 4,600 pounds.

Ganschow Worm Gear Speed Reducers

A fully inclosed worm gear speed reducer has been placed on the market by the William Ganschow Co., 1011 West Washington Blvd., Chicago, Ill. The cast-iron housing forms an oil reservoir and all moving parts run in an oil bath.

The standard units are equipped

Shop Equipment News



Ganschow Worm Gear Speed Reducers

with special bronze gears. The gears are generated on a tangential-feed hobbing machine. The smaller units have a solid bronze gear and the larger units have a bronze rim shrunk and studded on a cast-iron center.

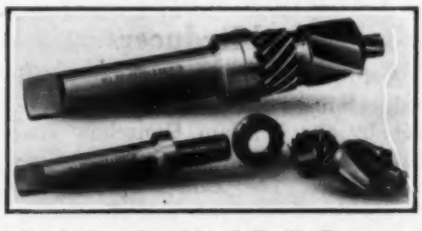
The material from which the worms are made is 3½ per cent nickel steel, S.A.E. No. 2320. The case on the worm threads has a scleroscope hardness of from 80 to 85. The worm and threads are ground. The pressure angle of the worm thread is 22½ deg. on the axial section.

Anti-friction thrust bearings are used throughout. Either ball or roller bearings can be fitted to the units. The gear bearings are held in place by means of clamping plates, as in the duplex worm thrust bearing. The front radial worm bearing is free to float to compensate for expansion due to heat.

Brubaker Combined Drill Reamer, and Countersink

A tool designed to drill, ream, and countersink flue sheets has been placed upon the market by W. L. Brubaker & Bros. Co., 50 Church Street, New York, N. Y. It will do in one operation what is usually done in three operations.

The tool can be furnished in any size desired and with any style or size of shank. The drill bit, the reamer, and the countersinking tool are each a separate piece. The drill bit acts as a nut to hold the other two tools on the shank. If the parts wear out, they can be replaced since all tools are made up to a master and are interchangeable.

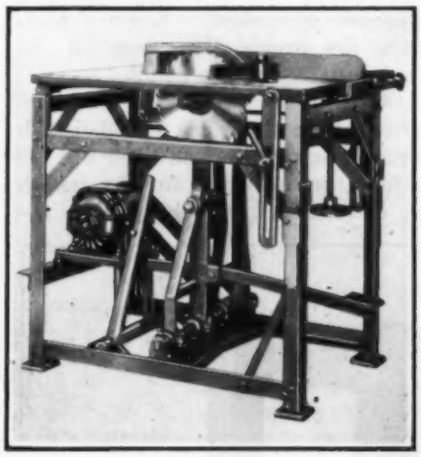


Brubaker Combined Drill, Reamer and Countersink

St. Louis Machine Tool Co. "Wonder" Saw Table Portable

The "Wonder" portable saw table is being marketed by the St. Louis Machine Tool Co., 1429 Pine St., St. Louis, Mo., for use with either cut-off or rip saws. The saw table can be furnished with either an electric or a gasoline motor. The former type of drive is illustrated.

The table top is made of cast iron, while the frame is constructed of angle iron bolted together. In either case the driving motor is mounted on a pedestal supported by the frame. Drive is by belt to a jack shaft, thence by a second belt, having an idler tightener pulley, to the saw. The entire saw unit is pivoted at the base about the centerline of the jack shaft, and by means of a foot-controlled lever the saw is swung through an arc and thus advanced through the work, which is held stationary. A stop is provided for this purpose when cutting off, while the plank must be clamped in place against a guide running lengthwise of the table for ripping work. By means of this method it is claimed that cramping of the board is prevented.



St. Louis Machine Tool Co. "Wonder" Saw Table, Portable

The saw regularly furnished with the table is 12 in. in diam. It rotates at 2,100 r.p.m. Rip, cross-cut, or any standard saw can be used. A graduated gage for mitering is supplied in addition to the guides for cross-cut and rip-saw work. The ripping fence or gage can be tilted to an angle of 45 deg. and is brought back to square against a stop. The table top measures 24 x 36 inches.

The electric motor is 1 hp., either d.c. or a.c. The latter is supplied for 110, 220, or 440 volts, 60 cycles, single phase. It is ball bearing equipped and rotates at 1,750 r.p.m. The motor is semi-inclosed.

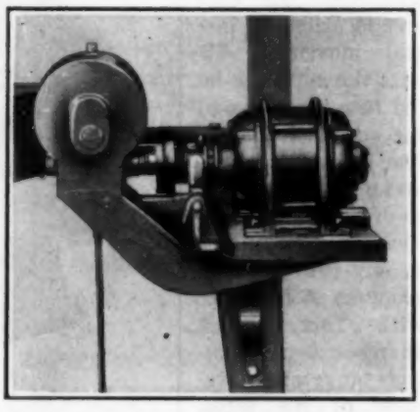
The gasoline motor is also rated at 1 hp. at 1,750 r.p.m. It is a 1-cylinder, 4-cycle motor, and has a built-in flywheel magneto, a set-jet type carburetor with an air cleaner, and an adjustable centrifugal-type governor. Lubrication is by splash and pump feed. The motor is air-cooled by means of a fan in the flywheel.

Utility "Motor-It" Speed Reducer Unit

The "Motor-It" speed reducer unit is being marketed by the Utility Manufacturing Co., Cudahy, Wis., for use with any type of small machine.

The unit as pictured has a disk clutch operated by means of a foot lever and is intended for short intermittent operation. For longer intermittent operation an expanding-type clutch is furnished, while for an electrically controlled machine a flexible coupling is used.

The motor runs at 1,800 r.p.m. and any desired speed reduction can be specified. Reduction is made by



Utility "Motor-It" Speed Reducer Unit

Shop Equipment News

means of a worm and wheel or spiral gears. Roller or ball thrust bearings are used. These units can be applied to any type of machine now driven by means of a belt or gear. The Motor-It unit can be put on the shaft in place of the tight and loose pulley or clutch, since the unit is bored to fit the customer's shaft. The gear set is completely inclosed.

The unit is furnished with motor, clutch, and reduction gear. The motor is supplied in ¼-, ½-, ¾-, 1-, 1½-, and 2-hp. sizes.

Atkins Metal-Cutting Band Saw, No. 4

The No. 4 metal-cutting band saw shown in Fig. 1 has been placed on the market by E. C. Atkins & Co., Indianapolis, Ind. The machine is motor-driven through a three-speed gear box, as illustrated in Fig. 2. Roller bearings are used throughout and the gears run in oil.

The machine is designed so that all parts are accessible and easily cleaned. The joints are machined and held by dowel pins. The amount of weight put on the rack determines the pressure of the blade which is fed by gravity. The blade runs between roller bearing guide rolls to insure the straightness of the cut. A handwheel, which can be seen at the top of the column, adjusts the tension on the blade. The machine is operated by a ¾-hp. motor.

It is claimed that the saw will cut machine steel at the rate of 2 sq.in.

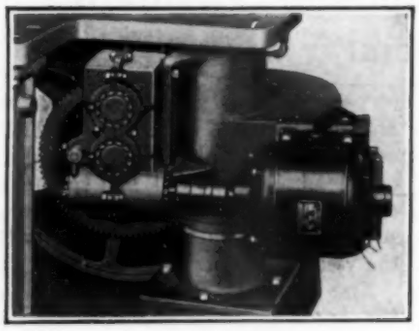


Fig. 2—A view of the motor drive

per min., and tool steel at the rate of 1 to 1½ sq.in. per min., depending on its hardness and toughness. The capacity of the machine is 12x18 in. The table is 28 in. from the floor and 13x32 in. in size. The height of the machine is 74 in., the floor space occupied is 36x50 in., and the weight of the machine is 1,500 pounds.

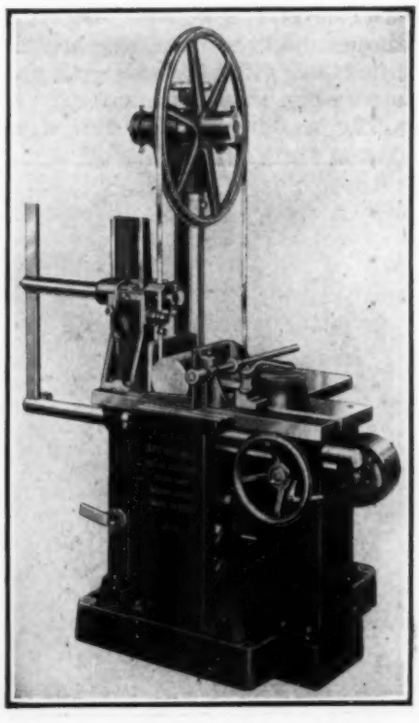


Fig. 1—Atkins Metal-Cutting Band Saw, No. 4

Wahlstrom Safety Tapping Chucks

Three sizes of safety tapping chucks have been placed on the market by the Wahlstrom Tool Co., 5524 Second Ave., Brooklyn, N. Y. The No. 201 special chuck for taps up to ¼ in. is shown in Fig. 1, while in Fig. 2 is shown the No. 202 chuck for 5/16- to ⅜-in. taps. The No. 203 chuck is designed for taps up to ½ in. in size. The tapping chucks are particularly designed to provide positive-drive, bottom-hole, tools.

The chucks can be set to a tension at which they will release the taps to prevent breakage. They can also be used for driving studs. The small chuck is composed of four principal sections, while that shown in Fig. 2 has three sections. The No. 201 chuck has a top cover that takes the thrust of the main spring and which can be used for the setting of the tension. It has a scale that can be used in connection with the arrow on the tension sleeve to show the degree of tension. The tension sleeve is used to adjust the spring tension by turning from right to left, using the arrow as a starting indicator. The lock nut is used to tighten the tension sleeve. The bottom section holds the tapping or stud-driving jaws.

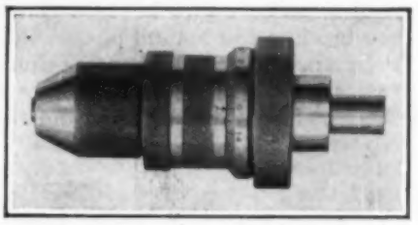


Fig. 1—Wahlstrom Safety Tapping Chuck, No. 201

The larger chuck has a top cover which takes the thrust of the main spring. It has an arrow on its side which is used as a starting indicator for the scale on the body. The body is made of two shells. The inside shell holds the main spring and ball sockets. The outside shell is used to adjust the spring tension by turning from left to right. It also has a scale for reading the tension and a setscrew to lock the shell at a predetermined tension. The bottom section, as in the small chuck, holds the tapping or stud-driving jaws.

To adjust the small chuck, the tap is inserted in the jaws and the lock nut is loosened by turning to the left. Starting at the arrow on the side, the tension sleeve is turned to the left little by little until the tap is actually biting. The lock nut is then turned to the right to fasten the sleeve for the tension thus obtained.

On the large chuck, the tap is inserted in the bottom section. The tap cover is then held with a wrench and the setscrew in the outside shell of the body removed. Starting with the outside shell of the body turned as far back to the left as it will go, it is turned slowly to the right until the tap is actually biting. The setscrew is then replaced and tight-

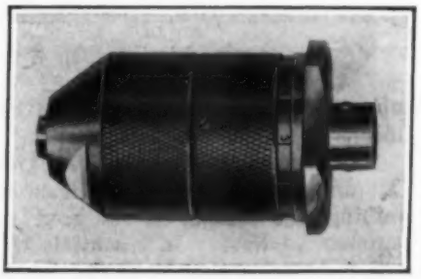


Fig. 2—The No. 202 tapping chuck

Shop Equipment News

ened to hold the shell in place. When the tap hits the bottom of the hole, the extra tension placed on the chuck forces out the three ball clutches in the inside shell of the body and the tap stops while the spindle is still revolving. When the chuck is put in reverse the balls drop back again in the clutches.

The chucks can be used on any radial drilling machine that has a reversing feature.

Rockford Double-Spindle "Rigidmil" Special

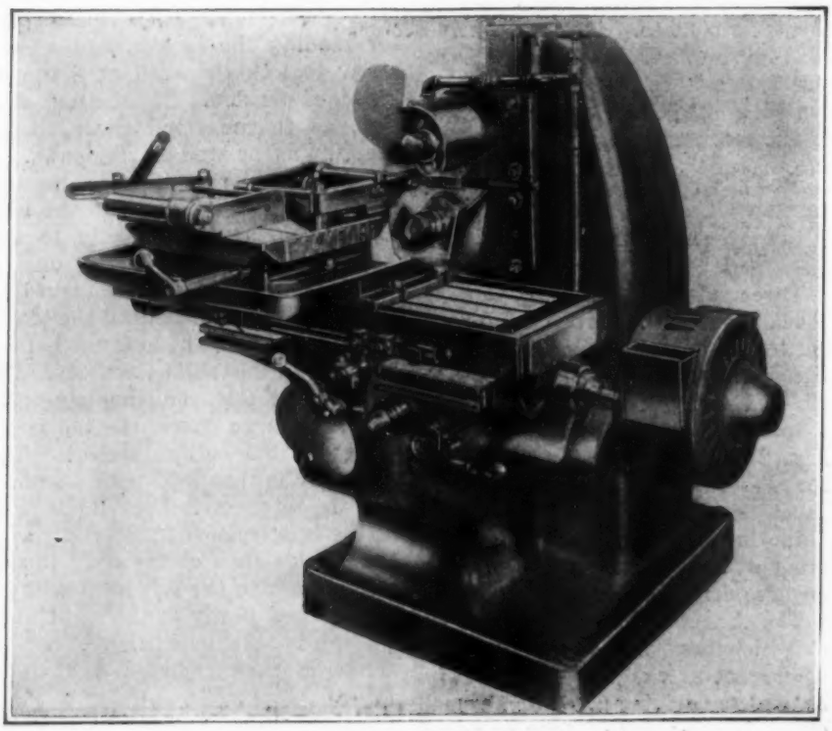
The Rockford Milling Machine Co., Rockford, Ill., has announced the double-spindle "Rigidmil" with a special indexing table shown in the accompanying illustration. The machine is designed for milling bolt bosses, and for slitting automobile connecting rods.

The two cutter-heads of the "Rigidmil" are independently adjustable. The vertical adjustment of the two heads in unison is made from the main adjustment at the front of the machine, while the space between the upper and lower head is varied by means of a vertical screw.

The machine is designed for rigidity under the severe conditions of milling the special steels used in automotive work. In essentials the construction is similar to the standard single-spindle machine described on page 901, Vol. 61, of the *American Machinist*. The machine is built with a large base having a low center of gravity. The knee and saddle is cast integral with the column, and support is given directly in line with the thrust.

The spindles are gear driven, and the speed changes are obtained by the use of pick-off gears in the speed-box at the front of the machine. The speed mechanism is mounted on Timken bearings, and is packed in heavy grease. The feed-box is also a separate unit in the front of the column under the table. The feed control lever is at the front.

The machine is designed with a fixed-height table at a convenient height for loading and operating. It is equipped with an automatic rapid traverse.



Rockford Double-Spindle "Rigidmil," Special

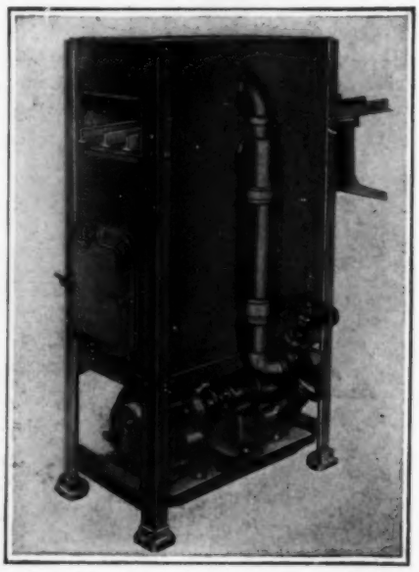
"Autosan" Parts-Washing Machine, Improved

The Colt's Patent Firearms Manufacturing Co. of Hartford, Conn., has brought out an improved model of the "Autosan" parts-washing machine especially adapted for use in connection with the Blanchard automatic grinding machine or machines of a similar nature.

In this model of the "Autosan" there is no mechanically-driven work carrier, the parts to be washed being pushed through a skidway by the following pieces ejected from the machine with which it is used. A double spray, one above and one below the work, delivers approximately 100 gal. per min. of the washing compound under a pressure of 7 lb. per square inch.

The spray nozzles are made entirely of brass and are easily removable from the machine for inspection and cleaning. The base of each nozzle where it attaches to the discharge pipe is a square flange having a slightly tapered, or wedge-shaped, section, which fits into a correspondingly tapered socket so that the nozzles are not only held in place by gravity but any jarring of the machine serves only to settle them more firmly in contact. The cover of the machine is hinged, and when it is thrown back both nozzles may be lifted out without disconnecting or unscrewing them from sockets.

The washing compound is circu-



"Autosan" Parts-Washing Machine Improved

Shop Equipment News

lated by a special Colt pump, directly connected with a standard electric motor and running on ball bearings. Motors for any commercial voltage or frequency may be furnished with the machine. The heating medium is a General Electric universal immersed unit, so constructed as to use the same current as that supplied to the motor. One or two units can be used as desired.

A fine-meshed screen of brass wire strains the liquid after it has passed through the spray nozzles and before it is returned to the suction side of the pump. A large door, gasketed to the side of the machine as shown in the illustration, gives access to the interior for cleaning purposes. The tank is divided into two compartments by the screen, which is held in place only by gravity and may be lifted out through the opened cover at the top.

The height of the skidway through which the work passes is made to correspond with that of the delivery side of the machine with which the "Autosan" is used. The floor space occupied is 20x28 in., and it weighs approximately 575 pounds. A 1-hp. motor drives the pump.

Hoefer Double-End Drilling, Boring and Reaming Machine, Special

A machine for boring and reaming the roller bearing seats in a rear axle of an automobile and simultaneously drilling two sets of holes for attaching the brake units has been built by the Hoefer Manufacturing Co., Inc., Freeport, Ill. The machine is illustrated. It is intended for high production with accuracy, and while it is quite special, the principles involved will lend themselves readily to a variety of work of a similar character.

The machine has a substantial bed with a section designed to give strength and rigidity. On the ways of the machine are mounted two horizontal heads, each containing two spindles with two form cutters for the roughing and finishing operations, respectively. The spindles holding these cutters are provided with longitudinal adjustment that permits of accurate setting for the depth of the cut and also compensates for the grinding of the tools. A cluster of eight drills surrounds the roughing tool in each head so that while the rough boring operation is in process, two groups of eight holes are being drilled in each end of the rear axle.

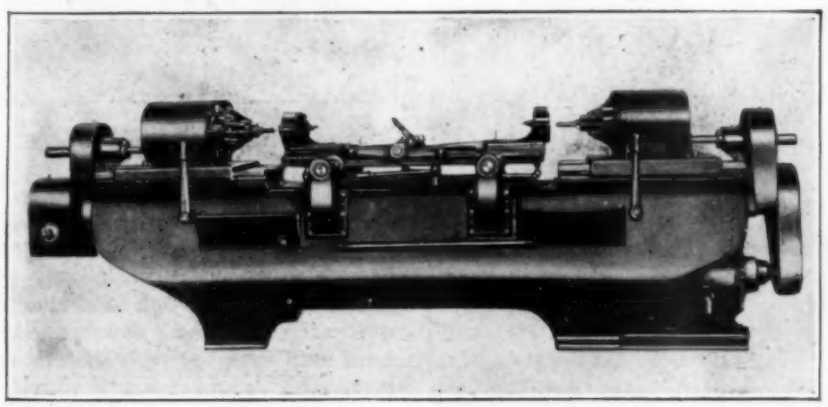
Motive power for the machine is derived from the electric motor mounted within the base of the machine. Power is transmitted to the main shaft by means of a set of sprockets and a silent chain. Power from the main shaft is transmitted to each individual head through a set of spur gears, while spindle speeds commensurate with the size of tools and work to be performed are obtained through gear ratios within the heads. The spindles are mounted on ball bearings. The spindles, as well as the gears, are made of hardened and heat-treated steel, ground to size. The head units run in a bath of oil.

In the center of the machine is mounted the work-holding fixture. The main part, or base of the fixture, slides on the two horizontal bars, the supporting brackets of which can be readily seen in the photograph. Lateral motion from one spindle to the other is obtained by means of the horizontal lever in the center of the machine through a cam action. Motion in both directions is limited by positive stops.

The work is brought into accurate alignment by means of two movable locating units mounted on the fixture base. These units are operated by the double-handle lever shown in the center of the fixture and are moved either in or out simultaneously. Hardened tool steel bushings locate the work in both of these holding units and are used also for pilot bushings for the tools in the heads while a group of drill bushings surrounding the large center bushing guides the drills.

The fixture is then moved to its first operating position and the feed is engaged by either one of the two inter-connected levers at either end of the machine. The feed is obtained through a set of cams mounted on a shaft running the full length of the machine. These cams are arranged for the following cycle of operations: rapid approach, cutting speed, rapid reverse, and dwell. At the end of each cycle, the feed is automatically disengaged. After the roughing operation has been performed, the work-holding fixture is moved to its second position for the finishing of the roller bearing seats.

In the base of the bed is a large tank for the storage of cutting liquid, which is fed to the cutting tools by means of a geared pump, also located within the machine bed.



Hoefer Double-End Drilling, Boring, and Reaming Machine, Special

"Flexoid" Shaft Coupling

A flexible shaft coupling, known under the name of "Flexoid," has been placed on the market by the Smith Power Transmission Co., 1218 Ontario St., Cleveland, Ohio.

The "Flexoid" coupling, an application of which is shown in the accompanying illustration, consists of two cast-iron flanges coupled together with one or more flexible

Shop Equipment News

"Flexoid" Shaft Coupling Installation

fabric disks in such a manner that there are no metal-to-metal bearing surfaces.

A joint of high strength and flexibility is claimed for the "Flexoid" coupling. The joint is designed to permit a 6-deg. misalignment of the shafts without chatter. It requires no lubrication. The fabric is specially treated, and is impervious to oil and water. It also insures complete electrical insulation of the sections of the shaft. "Flexoid" couplings are made in eight sizes with capacities from 2 to 100 hp. at 1,000 r.p.m. The couplings can be used efficiently on reversing drives, and are claimed to absorb shocks.

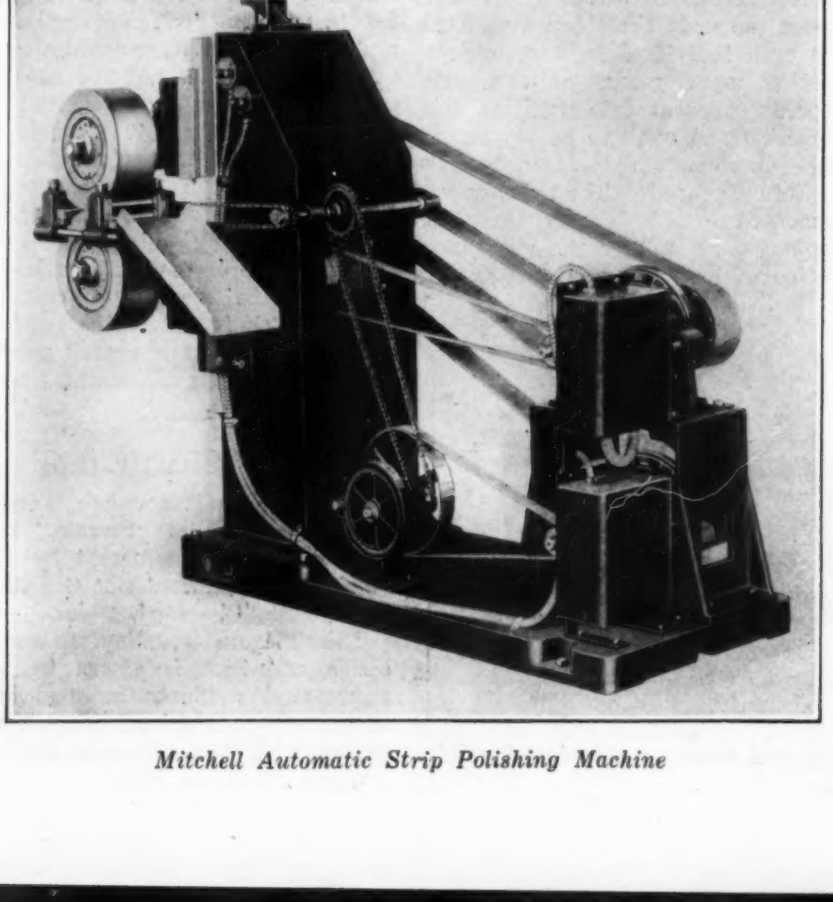
Mitchell Automatic Strip Polishing Machine

A special machine for automatically polishing both sides of strip metal or narrow sheets, simultaneously, has been designed by the Mitchell Engineering Co. of Springfield, Ohio.

The machine is provided with two wheelspindles, one above the other. They can be adjusted vertically to accommodate various thicknesses of material, and to compensate for wear of the wheels. Each spindle is driven by a separate motor. The lower motor, in addition to driving the lower wheelspindle, furnishes power for operating the strip feed rollers, as may be seen in the illustration. The upper motor also serves a double purpose; besides driving the upper-wheel spindle, it operates an oscillating mechanism for moving the upper and lower wheelspindles back and forth sidewise. To permit these movements both wheelspindles are mounted on horizontal slides, which are in turn carried on vertical slides. The oscillation of the spindles imparts a wavy surface to the strips being polished and it is claimed that deep scratches in the work are obviated and that the wheel surfaces are kept true and parallel.

In operation the strip is started into the feed rollers which carry the strip between the polishing wheels and discharge it at the rear of the machine. The rate of feed is dependent upon the material being polished and the finish desired. The machine can be arranged for polishing or buffing only one side of the strips or narrow sheets by eliminating the lower spindle and wheel.

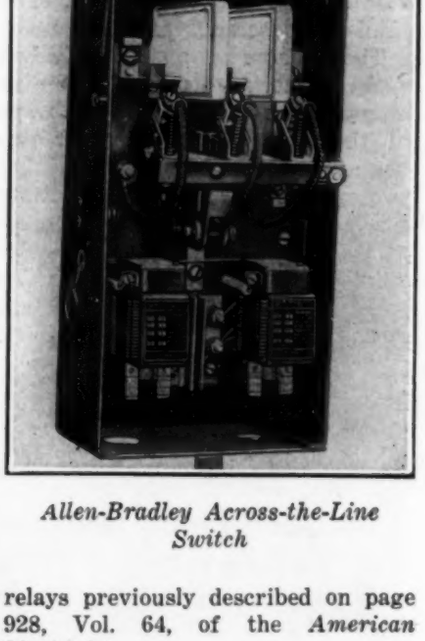
The weight of the machine complete with motors, starters and wheels is approximately 3,100 pounds.



Mitchell Automatic Strip Polishing Machine

Allen-Bradley Across-the-Line Switches

The across-the-line switch shown in the accompanying illustration has been designed by the Allen-Bradley Co., 286 Greenfield Ave., Milwaukee, Wis., to include the "Inducto-therm"



Allen-Bradley Across-the-Line Switch

relays previously described on page 928, Vol. 64, of the *American Machinist*.

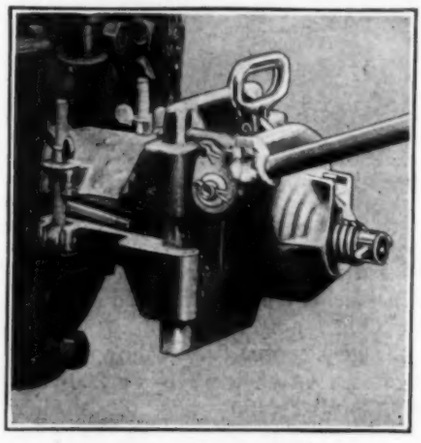
The improved switch is similar to the across-the-line switches that have been equipped with thermal relays. The use of the improved relays provides interchangeable thermal elements by adjusting the core.

Shop Equipment News

Duff Pinion Puller

The Duff Manufacturing Co., Pittsburgh, Pa., has placed on the market the pinion puller shown in the accompanying illustration, for railway, electrical and industrial mechanical and repair departments.

The puller consists essentially of two parts: clamping jaws and a screw jack. The jaws are of a thin-lipped design and are intended to fit over the pinion. The screw-jack section slides into the jaw section. When the jaws are attached, the operator turns up the screw until it makes contact with the shaft of the motor. A few strokes of the lever are



Duff Pinion Puller

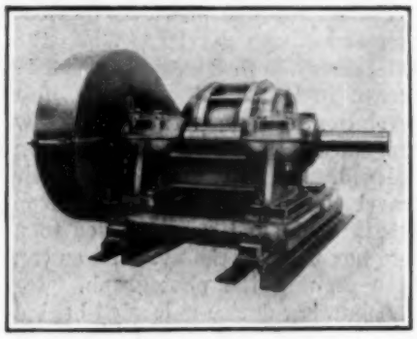
claimed to bring the device into full tension and then the pinion can be removed.

Three sizes of jaws are available for various sizes of pinions, pulleys or small flywheels. The housing and the jaws are made from casehardened steel and ball bearings are used throughout. A uniform force is exerted around the circumference of the pinion. The device weighs 50 pounds.

General Electric Back-Geared Induction Motor Drive

A back-geared attachment, designed for use with its Series 500 induction motors, has been placed on the market by the General Electric Co., Schenectady, N. Y. The illustration shows the device used in connection with one of the motors.

The base to which the motor and the back-shaft pedestals are bolted and doweled, is a single, large cast-



General Electric Back-Geared Induction Motor Drive

ing. A special unit-type pedestal is used, one casting forming the housings for the large back-shaft bearings. Thus rigidity and permanent alignment of the shafts, and meshing of the gear and pinion are secured.

The back shaft is provided with shoulders to limit end play and is made of special steel. It is supported by two large double-seated split bearings in dust-proof housings which hold sufficient oil for a number of months of operation.

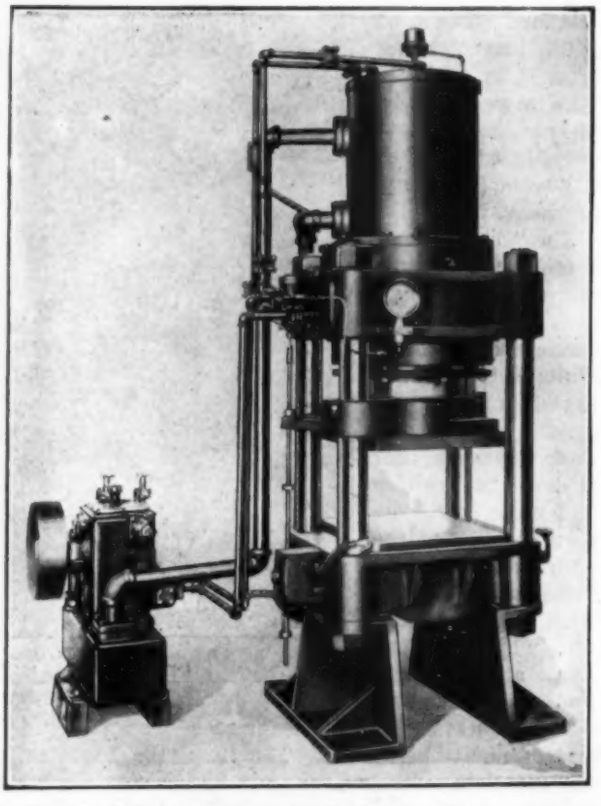
A split gear case, fabricated from steel plates, protects the gear and pinions from dust and retains the grease or oil in which the gear runs. Two standard gear ratios are available. Steel or fabroil pinions with cast-iron gears may be used. Two box-type welded rails with an easy adjusting feature complete the equipment.

Oilgear Hydraulic Press, 200-Ton

A 200-ton hydraulic press designed especially for the pressure forming of soft-base bearings has been built by the Oilgear Co., of 659 Park St., Milwaukee, Wis. The general construction of the machine can be seen in the accompanying illustration.

The press is of the four-column type. Its stroke is 6 in. and its clearance between the columns is 24 in. The daylight space is 18 in. The press has a rapid approach to the work at a rate of 100 in. per min. and quick return at the rate of 200 in. per min. The Oilgear pump used for actuating the press is equipped with a pressure variometer which enables the operator to adjust the line pressure to between 300 and 1,000 lb. per sq.in. The press is capable of making ten 6-in. strokes of 200 tons pressure per minute.

The basic design of the press is somewhat similar to that of the 50- and 100-ton high-speed hydraulic presses built by the Oilgear Co., and described on page 39, Vol. 63, of the *American Machinist*. The machine will hot press the bearings on which it is used at a temperature sufficiently low to leave the analysis of the metal unchanged. It is so con-



Oilgear Hydraulic Press, 200-Ton

Shop Equipment News

structed that it will hold the maximum desired pressure for an indefinite length of time, if necessary, to allow cooling. The pressure, it is claimed, can be held constant and without pulsation.

The oil pump and the press are made in a complete unit so that no other equipment is necessary. The pump is mounted on a base adjoining the machine. From the pump the oil is transmitted to the cylinder where it is applied directly to the piston or ram of the machine. The speed of the ram is changed automatically by means of valves which control the flow of the oil from the pump. The pump can be belt or motor driven.

Pellow "Duplex" Nut-Slotting Machine

The Pellow Machine Co., 6527 Epworth Blvd., Detroit, Mich., has announced its "Duplex" production nut-slotting machine shown in the accompanying illustration. The machine is designed for the rapid slotting of the most commonly used standard sizes of castle-nuts ranging from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. The machine is claimed to have a working capacity of 3,100 completed nuts per hour.

The "Duplex" machine has two nut-carrier lines, one on each side. These carriers are endless chains, each containing 63 units. The carrier passes over a way, and each unit is held in position under the saw independently of the other units. The units are provided with collet sockets into which the collets are inserted and held securely. Sets of collets are furnished for each size of nut to be slotted. The time of complete change-over of the machine is claimed to be only 20 minutes.

Three saws are provided in position above each carrier. When the nut passes the first saw, the collet is turned in its socket one-sixth of a revolution, and after the second saw completes its cut the collet is again indexed. At the end of the carrier travel the nuts automatically drop into a chute and are conveyed to a tote box beneath the machine as can been seen in the photograph.

A burring device is located behind each saw and is designed to remove the burrs as the nut passes. The burring tool is automatic in adjustment, and operates on all sizes of nuts independent of the width of the slot. A safety box and gage is placed on each side to prevent the passage of an improperly located nut. In case that a nut is not placed in proper position on the carrier unit the motor switch is thrown off by the action of the gage and the machine is automatically stopped.

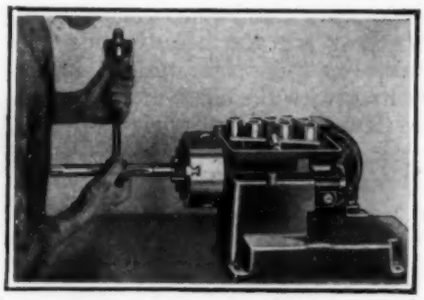
The saws have a speed of 200 r.p.m., and the nut carrier travels at a constant speed of 32 in. per minute.

Pellow "Duplex" Nut-Slotting Machine

The power is transmitted through the machine by chains and gears. The six saws are driven by a single chain. The machine is furnished with motor drive.

Van Norman "Reamo" Piston and Connecting-Rod Reaming Machine

The bench-type motor-driven reaming machine illustrated was designed by the Van Norman Machine Tool Co., Springfield, Mass., for finishing piston and connecting-rod bushings, but it can be adapted also to general machine shop use in place of hand reaming methods. In the illustration a connecting-rod bushing is being reamed.



Van Norman "Reamo" Piston and Connecting-Rod Reaming Machine

A $\frac{1}{4}$-hp. motor drives the unit and operates on either 110- or 220-volt, single-phase, 60-cycle, alternating current. The motor can be supplied also for 25- and 40-cycle, single-phase, current. The motor drives a worm and wheel through intermediate spur gears. The spur gears are exposed but the worm and wheel run in a bath of oil. The final spindle speed is 30 r.p.m. A chuck is provided that is adjustable to hold reamers ranging from $\frac{1}{4}$ to $1\frac{1}{2}$ in. in diameter for finishing bronze bushings.

The work is held in the hand and if a hard spot is met the hand can be released so that the reamer is not broken. It is claimed that this power drive produces a smooth polished bearing surface that is free from chatter marks.

Pamphlets Received

Paper-Wrapped Packages. Domestic Commerce Series—No. 3. Published by the Department of Commerce, Washington, D. C. The wrapping of various commodities in paper, and the weight, preparation, fastening and marking of packages are discussed in this bulletin.

News of the Week

French Machinery Builders Making Big Improvements in Design and Operation

Individual motor drive, lower working heights, lubrication and mass production methods all helping to rejuvenate industry

BY OUR PARIS CORRESPONDENT

The general economic and industrial situation in France is still clouded by many contemporary issues. The violent foreign exchange fluctuations of the past month have seriously handicapped all business dealing with futures and have brought the same instability to production costs and selling prices alike.

It was observed at the recently closed Foire de Paris, where machine tools formed an important part of the exhibits, that more and more they are being operated by individually geared electric motors. It was remarked also that mass production methods, where adopted, have called for complete new lay-outs and plans in many manufacturing plants, and at last France appears to be getting in line on this basis, at least in the automobile, electrical machinery and other like industries. The progress made during the past five years has been phenomenal. Incidentally, there is a tendency among French builders of machine tools to reduce the height and bring the working planes nearer the floor. The most important new models are not above 70 centimeters from the floor. Lubricating methods have been improved and helical gears are being adopted wherever possible.

SEEK SPECIAL ACCORD

Since the war France has greatly developed the production of drills and boring tools and has notably increased their export. Complaint is made that they are now virtually shut out from the Spanish market by virtue of the late customs accords which, on these items at least, are said to boost them so as to exceed the factory price by 300 per cent. The French commerce department is seeking to have a special agreement with Spain covering taps and dies and the like, whereby French manufacturers may be specially favored. It is difficult to see how a special accord can be brought about on such a narrowed-down issue save as a talking point in some far-reaching political agreement which may be forthcoming as a result of the Franco-Spanish-Moroccan settlement. The point is mentioned because it is closely connected with the interests of American manufacturers of like goods in the peninsula.

The general situation in the small metal goods and builders' hardware trades shows a diminution in volume of business all along the line. Plants which have not developed export outlets of a certain magnitude, or at least working toward that end, are frankly in a discouraging position. Building operations within the country have slowed down thus reducing demand for equipment and fittings. Galvanized tubes are at a price which makes the use of lead pipe prohibitive, and makers of wire and wire net products are behind in orders. These however are only minor aspects which are more favorable than are generalities. Chain manufacturers still report orders in hand with prices firm but with a tendency toward a further rise. Most prices have risen 10 per cent, wire goods 5 per cent, and split pins, bolts and nuts and the like from 3 to 23 per cent.

NEW CLASSIFICATION

The new French tariff classification on many items is still going forward and in all cases, in addition to the 30 per cent increase provided for in the last finance bill, this means a revision upward. The latest list published by the *Journal Officiel* includes "valves of metal, automobile springs, wireless radio accessories, measuring devices" and various electric and machinery parts. Ball bearings now carry customs dues ranging from 35 per cent ad valorem at minimum tariff to 70 per cent for the general tariff. Ventilating fans, per 100 kilos, are taxed variously from 75 to 150 francs, multiplied by a coefficient of 4.16 in the general tariff.

The communist movement in the Paris district has led to two serious strikes recently in the automobile industry, notably at the Citroen and Renault plants. It is estimated that more than 30,000 workers have been affected, but these are almost the sole manifestations of serious labor troubles for some time past. In each case the strike was brought about by increased wage demands of 10 per cent, and was settled in each instance by compromise.

The industry regards the invasion of the American automobile in greater volume—there being twenty-one well known American makes represented on the French market—as something of increasing seriousness. According to a statement by Edsel Ford just before he sailed for America, the Asnières Ford plant here is turning out eighty cars per day, utilizing in no small measure French materials and employing 85 per cent of French labor. It is estimated that four billion francs worth of American automobiles are being brought into France each year, the industry as a whole recognizing that American super-production methods make this possible, considering the high tariff charges and exchange rates of the day.

Comparing the situation with what has gone before in the agricultural machinery industry, it is believed that the conditions as they exist are the explanation of why the French automobile industry is not progressing more rapidly than it is, though the high cost of motor fuel and lubricating oil is of itself a retarding influence.

The labor situation still shows shortage, which will probably increase owing to extra work required in the coal mines of the North and East and the heavy metallurgical industries as a result of the British strike. The metallurgical industries demanded eight hundred more hands than the government labor bureau was able to supply in the last week in May. During that period 3,179 foreign workers of this class were "imported," chiefly from Poland and Italy. The government bulletin of the same date indicates labor shortages in the metal fabricating trades of the east of France, the Southwestern mines and in the lower Loire valley. A shortage of skilled labor also persists in the Paris district in the machine tool trade and the aviation and building hardware and plumbing industries.

Aeronautic Meeting at Philadelphia

Plans are being made for a two-day aeronautic engineering meeting to be held in Philadelphia by the Society of Automotive Engineers just before the national air races there. The dates selected probably will be Aug. 30 and 31, and the place the Bellevue-Stratford Hotel. Considerable attention will be given in the addresses and discussion to the subjects of design, construction and operation of both heavier and lighter than air craft.

As the meeting will be held at a time when the Sesqui-Centennial celebration is in full swing, there will be a triple attraction for the members of the society. That aeronoutics is occupying a prominent place in the minds of automotive engineers at this time is indicated by the fact that two days are to be devoted to the S. A. E. meeting this year as against one day last year.

Purchasing Agents at Los Angeles

Three days of discussion of problems peculiar to the man who buys supplies for large industrial corporations made up an interesting program for the eleventh annual convention of the National Association of Purchasing Agents, held in Los Angeles, Calif., June 9 to 12. Robert M. Sedgewick, president of the association, presided.

A multitude of subjects relating to purchasing were taken up by speakers, chosen from the more than two thousand delegates who attended. Symplification and standardization came in for no little attention, as it is one of the aims of purchasing agents to lower the cost of commodities through the elimination of unnecessary materials and the lessening of variety.

Among the speakers and presiding officers at the section meetings were J. W. Nicholson, chief buyer and secretary of the board of purchases, Milwaukee, Wis.; Walter N. Kirkham, state purchasing agent, Baltimore, Md.; Lewis A. Jones, purchasing agent Adirondack Power and Light Corporation, Schenectady, N. Y.; L. F. Boffey, purchasing agent the Detroit Edison Co., Detroit; N. L. Morse, purchasing agent, Southern California Gas Co.; T. B. Parks, purchasing agent, Los Angeles Gas and Electric Co.; George H. Pohler, purchasing agent, Mid-Continent Petroleum Co., Tulsa, Okla.; A. V. Howland, Boston; Victor E. Hecht, Los Angeles; Arthur P. Allen, Norwood, Mass.; A. H. C. Boissier, Denver; J. L. Morrow, Seattle; H. W. Bruce, purchasing agent, University of Southern California; L. C. Haskell, Montreal; and Dr. R. B. von Kleinsmid, U. S. C.

The "Informashow" held in conjunction with the convention proved to be a very valuable attraction. More than two hundred exhibitors used the space provided for exhibits of merchandise, and one hundred and fifty nationally advertised lines were shown. Every phase of the nation's industrial life was represented, from office appliances to machinery and factory equipment.

At the closing session of the convention the association adopted a resolution calling upon the government to begin a study into the possibility of converting the desert wastes on the Pacific Coast into tree bearing areas.

Kirke H. Taylor, purchasing agent for the Illinois Glass Co., of Alton, Ill., was elected president for the next year. Lewis A. Jones, purchasing agent for the Adirondack Power and Light Co., Schenectady, N. Y., was elected treasurer. W. L. Chandler, of New York, was re-elected secretary.

Convention Committee for Steel Treaters

The Chicago Chapter of the American Society for Steel Treating has organized its convention committees for the eighth annual steel and machine tool exposition to be held in that city on the Municipal Pier, Sept. 20 to 24.

T. B. Purcell, vice-president of the Peoples Gas, Light and Coke Co., is general chairman of the committees and is assisted by the following: Robert G. Guthrie, Peoples Gas Light and Coke Co., Chicago, Ill.; J. Fletcher Harper, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.; Arthur G. Henry, Danly Machine Specialties Inc., Chicago, Ill.; S. M. Havens, Ingalls-Shepard Division, Wyman Gordon Co., Harvey, Ill.; Wm. R. Mau, Vanadium Alloys Steel Co., Chicago, Ill.; E. M. Converse, Dearborn Chemical Co., Chicago, Ill.; W. E. Williams, Metal Lubricants Co., Chicago, Ill.; H. Hardwicke, Atlas Steel Corporation, Chicago, Ill.; T. E. Barker, Accurate Steel Treating Co., Chicago, Ill.; P. G. B. Morriss, The Drake Hotel, Chicago, Ill.; E. Von Hambach, Boyle Valve Co., Chicago, Ill.

S.I.E. Studies Practical Means of Waste Elimination

With a three-day program given over to the major subject "Practical Methods for Eliminating Waste," the thirteenth annual convention of the Society of Industrial Engineers was held in Philadelphia June 16, 17 and 18. Headquarters were in the Hotel Bellevue-Stratford, where all the meetings took place.

The various technical sessions were divided so as to give each group a certain specified time for the discussion of its particular problems. Management, research, manufacturing, distribution, inspection, labor and office work were some of the main topics which the speakers debated.

The opening session was presided over by Wallace Clark, chairman of the management section of the society. Dr. W. F. Rittman, president of the society, addressed the members. At this session seven prominent executives presented actual cases of waste due to lack of co-ordination between various parts of a business.

The research committee's session was presided over by Perry A. Fellows, of Detroit. Two addresses were presented —"Prevention of Waste in Government," by Dr. L. D. Upson, of the Bureau of Governmental Research, and "Prevention of Waste in Industry," by F. O. Taylor, of Parke, Davis & Co., Detroit.

C. E. Knoeppel, managing director of Waste Eliminators, Inc., Boston, presided at the Management Session. W. B. Ferguson, production manager of the Newport News Shipbuilding and Dry Dock Co., Carle M. Bigelow, of Bigelow, Kent, Willard & Co., and John A. Riley, of the Palmolive Co., were the speakers.

The session on Distribution took up various phases of merchandising. Irving A. Berndt, managing director of the Chamber of Commerce, Joliet, Ill., presided.

"Labor" was discussed by Hugo Diemer, of La Salle Extension University, and by Harold J. Payne of the Society for Electrical Development. Other speakers at this session were W. D. Stearns, of the Westinghouse Electric and Manufacturing Co., and George Hodge, of the International Harvester Co.

Nation-Wide Observance of Management Week

Philadelphia, Meriden, Conn., and Lafayette, Ind., are the first cities in the country to form committees to plan for observing Management Week, Oct. 25 to 30, during which industrial and commercial organizations in more than 100 leading centers will review progress made in the elimination of waste during the last five years. Announcement of these developments was made last week by R. M. Hudson, chief of the Division of Simplified Practice, secretary of the National Management Week Committee, which includes the American Management Association, Society of Industrial Engineers, American Institute of Accountants, American Society of Mechanical Engineers and Taylor Society as sponsoring organizations.

Organization work is also well under way, Mr. Hudson states, in Massachusetts, New York, Pennsylvania, New Jersey, Michigan, Connecticut, Illinois, Iowa, Minnesota, Vermont and Ohio cities. Preliminary steps are also being taken in Delaware, Maryland, Virginia, Georga, Oklahoma, as well as in the Rocky Mountain and Pacific Coast states.

The purpose of Management Week is to discover, as far as possible, the benefits gained by the industrial and commercial fields from the co-operative attacks on waste following surveys made by the Hoover Committee on Elimination of Waste in Industry, the Committee on Business Cycles and Unemployment and the National Distribution Conference. Each of these surveys indicated certain recommended co-operative steps to overcome waste and to improve the efficiency of management. The putting into effect of these recommendations, the National Committee believes, has had a wider influence on stabilizing business than is generally recognized.

Oil-Flow Tests to Aid Lubrication of Aircraft

The characteristics of lubricants and lubrication systems with particular reference to the extent to which they are influenced by change in temperature are being studied by the Bureau of Standards under authorization from the Bureau of Aeronautics of the Navy Department.

At low temperatures such as experienced at times by aircraft engines, oil may flow slower than the proverbial cold molasses. For such conditions the dimensions of the pump and feed lines must be sufficient to insure adequate lubrication and yet provision must be made to prevent over-oiling when temperature conditions are such that the oil flows freely.

For the purpose of conducting the experiments an air-cooled radial engine has been mounted in a "cold room" and provided with the necessary equipment for measuring oil flow under various conditions. Measurements with this engine are being paralleled by an experimental study of the pump and other elements of the lubrication system.

Engineering Council Will Aid Hoover

Safety in industry, progress in radio, patent office conditions, and public works were the chief topics discussed at the two-day session of the administrative board of the American Engineering Council, which met in Detroit, Mich., June 4 and 5.

Dean Dexter S. Kimball, of Cornell, president of the council, presided at the meetings, which were held in the clubhouse of the Detroit Engineering Society. Numerous committees made progress reports and an active program was mapped out for the summer months.

In a statement summarizing recent activities President Kimball declared that the council was in a flourishing condition, and was engaged in notable public service in many directions.

L. W. Wallace of Washington, executive secretary of the council reported "decided and promising progress" in the safety and production study, the outstanding research problem undertaken by the council for 1926.

L. W. Wallace read the board a letter from Herbert Hoover, commending the committee on patent law procedure for its report, which he termed "probably the most complete and exhaustive that has ever been made on the subject."

In view of the investigation into the Patent Office and patent law which has already been made by this committee, of which Mr. Wallace was secretary, it was voted by the council not to make an independent study, but to continue to co-operate with Mr. Hoover's committee.

The question of registration and licensing of engineers for the public's protection, and the importance of developing more uniform standards in industry were also discussed.

Committee Working on Furnace Refractories

A joint committee on foundry refractories is conducting a survey of the service conditions of the refractories used in the different branches of the foundry industry. Subcommittees composed of representative foundry managers and metallurgists have been appointed by the committee to look after the detailed work connected with the surveys and to report at the meeting to be held in connection with the Detroit convention of the American Foundrymen's Association.

The subcommittee studying the malleable foundry refractories is asking that foundry managers co-operate by supplying such information as each may contribute. The committee is sending to each foundry a questionnaire which will be easy to fill out and yet supply the needed data. The questionnaire forms the basis for a systematic study for improvement in composition, manufacture, specifications, testing, and application of reverberatory furnace refractories.

The subcommittee conducting the malleable furnace service conditions survey is composed of:

James R. Allan, the International Harvester Co., Chicago;

H. M. Thompson, the H. M. Thompson Co., Chicago; and

J. H. Birdsong, the National Malleable and Steel Casting Co.

The "Joint Committee on Foundry Refractories" was organized by the American Ceramics Society upon the recommendation of the A.F.A. in 1925. At the present time twelve national organizations are co-operating in this undertaking by having a representative on the committee.

Vauclain Praises the Industry of Russia and Poland

The greatest need of Russia today is credit, and that of Poland is a more liquid and cheaper money rate. This was the gist of an address made by Samuel Vauclain, president of the Baldwin Locomotive Works, at a luncheon tendered him by the Export Managers' Club of New York, in the Hotel Pennsylvania on June 15. Mr. Vauclain returned recently from a European tour which took him through Russia and Poland, and in which countries he made a study of industrial conditions.

Mr. Vauclain cautioned his audience against believing the many supposedly authentic stories current today concerning Russia. He described the people as being content, industrious and making surprising progress in their economic readjustment. He paid a high tribute to the government officials for their willingness to co-operate with foreign industrialists who come to their country seeking business, but at the same time offering helpful suggestions. He said that Russia must eventually become a "United States of Russia" and that the sooner she arrived at that state the sooner would she begin to prosper. Russia must make her peace with the United States, must recognize past debts and give assurance of a desire to live up to the spirit and letter of business contracts before she may expect to resume diplomatic relations.

Mr. Vauclain devoted a good part of his remarks to a description of his journey on the Russian railroads, through the repair shops and locomotive building plants. He said that the machinery being used was antiquated, of a type similar to that used in this country twenty years ago. But he added that the rolling stock was in good condition and the roadbeds and buildings were in far better shape than we in this country believed.

Referring to Poland, Mr. Vauclain stated that the greatest need of that country today was a reasonable money rate. He said that business men were compelled to pay as high as 24 per cent for money. This prevents many from expanding their operations and in many cases has brought failure to those who could not pay the price for urgent loans. He paid high tribute to the business ability and integrity of the Polish people and humorously remarked that he was no more abashed at political conditions there than he was in his native state of Pennsylvania.

Effort Made to Promote Standard Gaging

During the Third International Standardization Conference a technical meeting on limit gaging was held under the chairmanship of C. E. Skinner, chairman of the American Engineering Standards Committee, in which delegates of eighteen countries took part. After an explanation of the basic principles of the British national standard system of tolerances and allowances had been given by Sir Richard Glazebrook, formerly director of the National Physical Laboratory of England, and after the basic principles of the German system had been explained by Dr. Otto Kienzle, delegate of the German national standardizing body, several delegates explained the various important points of their national systems. The delegates of Czecho-Slovakia, Norway and Russia stated that a proposal was now in the hands of their sectional committees.

On the American side it was stated that a study made of the several national systems now in existnce, had brought out the fact that for most of the eight American standard fits there can be found a German and a British standard fit which are practically the same.

It also appeared from the discussions that although originally there were in existence in Germany and Great Britain certain systems based on bilateral tolerances, the present tendency was strongly in favor of unilateral tolerances. All national standard systems now in existence (except the British) are based on the principle of unilateral tolerances exclusively. The British system gives both the unilateral and the bilateral systems but recommends the unilateral except in cases where it would conflict with present practice.

National Contest for Foundry Apprentices

In order to encourage apprentices and to direct attention to apprentice training work, there will be held in connection with the 1926 convention of the American Foundrymen's Association at Detroit a contest in molding for foundry apprentices. It is the hope of the officers of the association that this contest may become an annual event. At the convention in Milwaukee in 1924, such a contest was conducted by the association for foundry apprentices in Milwaukee, with satisfactory results.

This year the contest will be held on a national scale. The apprenticeship committee of the American Foundrymen's Association has selected patterns to be made in competition in both the steel and the grey-iron division. Blueprints of these castings are available which very clearly indicate the manner in which the patterns are to be made. Local contests will be sponsored by branches of the American Foundrymen's Association or other recognized organizations of foundrymen.

Further information regarding this contest together with a full set of regulations and blueprints of castings can be had from C. E. Hoyt, secretary, American Foundrymen's Association, 140 South Dearborn St., Chicago.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

THERE is nothing more fluid than money and its flow is as resistless as that of the tides. Last week an issue of $60,000,000 Federal Land Bank 4½ per cent bonds offered at 101 were sold in less than two hours. They had not been syndicated or underwritten. The public simply came and took them. Four days later the common stock of the U. S. Steel Corporation advanced to 139¾, at which price it will pay only 5 per cent even if dividends at the present rate are maintained.

These are but two out of many examples that could be cited to show that the reservoirs of capital in the United States are full to overflowing. The reason for this condition is not far to seek.

The French government seems unwilling or unable to save the franc which is again well below three cents. Brazil has withdrawn from the League of Nations, and that organization is now regarded as almost moribund. Poland is under the rule of a dictator. So is Portugal, and the end of the coal strike in Great Britain is not yet in sight.

No one knows what a day or an hour may bring forth on the other side of the Atlantic, and American investors are no longer willing to put their money in European securities.

Meanwhile this country is receiving an average of about a billion dollars annually to pay the interest on, or the principal of, foreign loans already made. This sum plus the excess of our current income is pressing for employment at home, as investors do not want foreign securities.

The consequence is an almost unexampled demand for good bonds and stocks. Barring some unlooked for cataclysm, it seems likely to continue until the market has reached a dangerously high level.

Meanwhile it is quite possible that the effervescent spirit of speculation that is already making itself felt may be extended to include commodities and staple merchandise.

Steel which has long been regarded as a "barometer" is higher. So is copper, as well as lead and zinc. The decline in rubber has been checked. Coffee is firm and higher, entirely because money to finance the Brazilian campaign for the "Defense of Coffee" has been obtained in London.

The domestic consumption of cotton in May was only 3 per cent under last year, despite the reports of Southern curtailment. The cotton trade seems to have made up its mind that the market is low enough if the crop does not exceed current estimates of about fourteen millions.

Wheat and corn as well as the other less important cereals have been steady to firm, and sugar has shown more strength than for some time. It may perhaps be far-fetched to say that cheap money is directly responsible for the more cheerful feeling that pervades the commodity exchanges, but it is undeniable that they often reflect the prevailing sentiment in the stock market and that they are now more responsive to developments than for some time.

What's Doing in Industry

While the actual volume of orders has not greatly increased, the general trend in the machinery and machine tool market has improved considerably in the past week. The month of June showed up better than May and the present listed needs of buyers gives evidence of good business before the real summer vacation period sets in. The outlook for fall business is good.

Most of the present activity centers in the Middle-West where new automotive projects are pending. Detroit is waiting for the large machinery orders which must follow recent announcements of expansions in at least two motor plants. In Chicago the improvement is being maintained with a good volume of inquiry in circulation. Railroads and general users of machinery have been active in Cincinnati and the month closed with a fair volume of new business.

Milwaukee reports a conservative market, with orders for replacement being placed in fair volume. Buying of machinery has been renewed in Cleveland, automatic equipment being in demand.

In the Eastern territory New York shows the best improvement. Sales have been more encouraging and the inquiry lists have increased in the past ten days. Buffalo reports an active demand for electrical machinery. Railroads have placed a few orders in the Philadelphia market and new inquiries promise more business from this same source.

The abundance of lendable credit is the most impressive feature of the general business situation in this country. Until this changes it is unlikely that there will be any serious decline in prices or the cost of living.

Increased cheerfulness is also noticeable in the distributive trade. It may be due in part to the warmer weather, but it is also attributable to the belief that the buying of stocks presages an increased demand for merchandise.

The president of the American Woolen Co. has issued an optimistic statement. The mail-order houses as well as the department and chain stores, all report a better business and jobbers admit a distinct improvement in the demand.

The promptitude with which the railways deliver the goods entrusted to them has put an end to large orders, but there has been a noticeable increase in the hand-to-mouth business and a substantial gain over May is now reported from many quarters.

In the grain states the expectation of better times has been encouraged by the hope that Congress will be impelled, if not compelled, to pass some measure for the relief of the farmers before it adjourns.

A foreign trade statement for May which shows that exports exceeded imports by $38,000,000 is also considered encouraging, although it is not regarded as conclusive.

But these optimistic generalizations should perhaps be qualified in some respects, for it rarely happens that the outlook is entirely cloudless.

It is therefore in order to note that land speculation throughout the country is subsiding; that a continued decrease in the new building planned is indicated; that rents at least in the larger cities are somewhat lower, and that production in many lines, including the automobile industry, is fully up to, if not in excess of the demand.

A perfectly adjusted situation is however as unthinkable as perfection itself, and the importance of the slight maladjustments that are normal is always exaggerated by those who suffer.

The important question is, Will money recover its pre-war purchasing power and when?

Those who know the correct answer may be able to forecast the course of prices, due to the trend of business.

But for the present at least the abundance of lendable credit is the most impressive feature of the situation. In this country it is due in part to our increased wealth, and in part to the existence of the Federal Reserve System. In Europe it is the result of inflation and the practical abandonment of the gold standard. These are conditions that promise to continue for some time yet, and until they are changed any serious decline in prices or the cost of living seems unlikely.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Milwaukee

Business in metal-working machinery, as judged by local manufacturers of such equipment, is again entering a state of improvement, although prospects are not regarded as possessing any signs of an immediate boom. Conservatism rules the purchase of metal-working equipment, and new tools are being acquired only when the need for them is strongly apparent and the possibility of idleness is remote. There is considerable activity in buying for replacement, and machine tool factories are keeping reasonably busy.

With a few exceptions, automobile shops are doing little buying except to piece out equipment or to make replacements for greater efficiency and to effect economies in production. The local units and parts industry, which is perhaps the most formidable of any market, has been tooling up steadily for a year and is now inclined to mark time, although delivery specifications from automobile factories are as a rule fully equal to contract agreements.

Agricultural implement and tool works have not bought as heavily as was expected earlier, when predictions were probably over-enthusiastic as to the state of the demand. The spring rush for equipment for farms is about over, and manufacturers are awaiting further developments.

Cleveland

Renewed buying of a wider variety of machine tools and general manufacturing equipment has come into the Cleveland market in the last two weeks. Orders booked, in several instances, indicate that manufacturing plants that formerly sublet part of their work are now buying tools, preparatory to completing their production within their organization and also to cut the cost of overhead and to have direct supervision.

Best business at the present time appears to be in the automatic machine equipment and planer field. Some plants have increased their night shifts in order to speed delivery of certain types of this equipment.

Inquiries are on the increase and with orders about to be consummated it is expected that the first half of this year will show a substantial gain over the same period of last year.

Cincinnati

A continued improvement in the market tone during the past week is reported by Cincinnati machine tool manufacturers and selling agents. While no great increase in sales is expected in the vacation period, it is thought that the trend of the market will be upward.

Single tools, bought because of greater efficiency than old, or for replacement purposes, continue to be the market feature. There has been little buying for expansion. The week's bookings were well diversified as to types of tools and sizes and the orders were well distributed over the country.

Some railroad orders were placed in the week, calling for single tools, and it is thought that orders for good-sized lists are about to follow. Several single orders were received from oil fields and a few came from the coal and coke industries. A fair amount of buying is reported to have been done by general machinists.

Business with the automobile industries showed an increase and it is thought that the requirements of concerns in this line will very soon grow larger. A better demand is also reported from concerns in the electrical industry.

More inquiries were received than in the previous week and these were well diversified and broadly scattered. It is thought that with the business that is now booked and with what is coming in factory production will be maintained at its present level.

Chicago

The improvement in the machine-tool market noted during the first week of June is being maintained on about the same level. Dealers in machinery, with few exceptions, say that recent sales have been encouraging, and that inquiries coming by every mail indicate that the volume of business for the month will exceed that of May by from 25 to 40 per cent.

Occasionally there is encountered a machinery house which claims to have experienced no slump during last month, but that is the rare exception. Concerns handling small tools, principally, report a gratifying trade, and inquiry elicits the information that this branch of the machine tool industry has scarcely felt the depression in business which has marked that of firms dealing more particularly in large, standard equipment.

There is a good inquiry for used machinery at low prices, and several worthwhile sales of standard tools have been effected within the last week. Inquiry for milling machines continues active, and manufacturers of this line have practically caught up with belated deliveries.

Railroad buying is negligible, and consists mostly of tools to close out old lists. Such demand as has developed within the last two weeks has had its origin in general industry throughout the Middle-West.

Detroit

Nothing of importance has developed during the past week in Detroit to indicate any immediate jump in the sales of machinery and machine tools in the automobile and other manufacturing plants in southeastern Michigan.

There has been a general tendency to expect a better turn in the market during the last half of the year, and a canvass of leading dealers in this city discloses ground for believing that conditions will be better within a few weeks.

Just what is going on at the Fordson plant of the Ford Motor Co. cannot be definitely learned, but that some large orders will be placed very shortly seems certain. Sales of the present Ford model have been far from satisfactory, and those in the know feel that an announcement of far-reaching importance to the automotive industry will be made before the end of the summer.

At the same time the General Motors plants are preparing for greater production. Much of the six million dollars which the Chevrolet Motor Co. will spend on machinery and machine tools for increasing production from 750,000 to 1,000,000 cars annually has already been contracted for. No extensive orders for the new Pontiac factory have been placed but lists are out and developments should come fast and furious.

Some sales of such standard equipment as milling machines, reamers, grinding machines, etc., have been reported in the Hudson and Studebaker factories. The Cadillac plant is buying toolroom equipment. The Packard plant has not finished its buying for the experimental department where the aircraft engines for the Navy will be built.

New York

With the month about ended sales of machinery and machine tools in this market show a fairly substantial volume. In the second half of the period there was a noticeable increase in inquiries and actual orders reached a satisfactory level.

Buying by railroads is especially active. The recent convention at Atlantic City no doubt had its effect on purchasing, as many dealers report pending contracts with railroads. The Atlantic Coast line is reported to be closing on the list of tools submitted for quotations several weeks ago. The New York Central also purchased several machines.

One dealer reports an order for 10 electrically-driven polishing machines, placed by a manufacturer of a metal specialty. Other orders included 3 high-speed drills, 2 cylinder grinders, 2 centerless grinders, 2 axle lathes, 6 automatic lathes, 2 die-sinking machines, two 12-in. vertical shapers and a variety of single machines.

Philadelphia

A note of optimism was sounded among machinery manufacturers and machine tool interests throughout the Philadelphia area last week, with the resumption of inquiries from some industrial firms, and some railroad buying.

One of the larger dealers in Philadelphia reported that several railroad orders had been placed with his firm, some coming from New England, one or two from New York and others from the Middle-West. The purchases, while not large, were encouraging and reports indicate an altogether hopeful situation.

The larger industrial plants are not now in the market for any extensive purchases, it is indicated. Inquiries from those sources have been few.

Manufacturers and dealers in road machinery report a fairly active business, due to the extensive highway construction programs which many of the Eastern and Mid-Western states have undertaken. The situation in the small tool industry has not shown much change in the last few weeks. Dealers attribute this largely to failure of the building program in some of the Middle-Western cities.

Buffalo

The trend of general machinery equipment business in this locality is upward. The change for the better was first noted about the first week in June. There is every indication now that June will be better in respect to volume of business than was May.

The electrical equipment business which has shown a steady and satisfactory business still continues to be the leading factor in the equipment field, there having been no noticeable let-up in many months, with every indication that it will continue.

More used equipment has been turned up in the machine tool field. This has not been altogether a pleasing factor in the new equipment market, which might be much better. Inquiries are good, however, although there are no large orders in sight.

Investigate Canadian Steel Industry

Much interest among those directly interested in the welfare of the Canadian metal-working industry is centered in the hearing which opened at Ottawa recently before the new Tariff Advisory Board, in the case of the steel industry, as embodied in applications by the British Empire Steel Corporation and the Algoma Steel Corporation. The hearing, it is expected, will develop into a general inquiry into the steel industry in Canada, and will continue over a period of several months.

At the preliminary hearing the Algoma Steel Corporation took the stand that the Canadian automobile industry was already adequately protected under the existing tariff. The company argued that consequently the "drawback" of 99 per cent enjoyed by the automobile manufacturers on several articles of steel was unjustified. The representatives of the British Empire Steel Corporation argued that it was not suggested that there should be any departure from the principles of the existing tariff, but that consideration should be given to the fact that owing to the greatly increased cost of market value of the materials subject to specific duties, the ad valorum effect of these duties had greatly decreased. Today these specific duties did not represent the same value that they did when they were imposed.

In a nutshell, the safeguard asked by the steel industry is adequate protection by means of customs duties, particularly in regard to imports from countries whose labor is cheap and whose currencies have depreciated.

Engineering Council Plans Study of Safety

To check the mounting number of industrial accidents a "safety and production study" has been started by the American Engineering Council, it has been announced by the president of the council, Dean Dexter S. Kimball, of Cornell University.

The results of this study, which aims to determine whether there is a definite correlation between safety and production, that is, whether the safe factory in general is the productive factory, and vice versa, are expected to hasten a new era of industrial safety in this country.

In spite of fifteen years of highly effective work in the safety movement, the number of industrial accidents in general still seems to be increasing, a result that is due apparently to the increasing mechanization of industry. Some means of getting an effective control of the situation must be found. Industry can and must devise ways to carry its operations on more safely.

Arthur W. Berresford, Detroit electrical engineer, who during the war was chairman of the General War Service Committee of the electrical manufacturing industry, has been named chairman of the committee of the American Engineering Council which will direct the survey. Leon P. Alford, of New York, who was a member of the Hoover Waste Committee, is vice-chairman. A group of field engineers will work in the important industrial centers of the country under the direction of Joshua Eyre Hannum, of New York, research engineer of the Eye Sight Conservation Council of America.

The field work, centering in New York and Washington, will embrace these ten basic industries: Iron and steel, steam railways, electric utilities, paper and pulp, mining, machine building and metal-working, textiles, cement, woodworking, building construction.

Machinery and Power Bring Higher Wages

How the introduction of more automatic machinery and improved methods of manufacture have resulted in a reduction of prices of products of the General Electric Co., as well as higher wages for employees, is pointed out in a statement made recently by Gerard Swope, president, in announcing figures of the company's business for the first three months of the present year.

A study of the company's largest factory, at Schenectady, where today 21,000 men and women are employed, indicates that supplementing the worker's skill by electrical power has enabled him to increase his earnings. This analysis covers the 12 years from 1914 to 1925 inclusive, that results before and after the war and post-war readjustments may be compared. During this period the cost of living increased about 68 per cent while the average earnings of the workers (not the hourly rate, but the actual dollars they received each week) increased 107 per cent—in other works more than doubled.

What the Railroads Are Doing

The New York Central is planning to purchase about twenty locomotives, according to reports in the equipment trade. The Norfolk & Western will build 250 flat cars in its own shops. The New York, Westchester & Boston has purchased ten motor passenger cars from the Pressed Steel Car Co. The Seaboard Air line is in the market for from thirty to forty express cars.

The Pennsylvania Railroad is in the market for 50,000 tons of steel products. Bids have been asked on some 15,000 tons of plates, 6,000 tons of bars, 1,000 tons of shapes and large quantities of sheets, wire, axles, spikes, bolts and bars. The Great Northern Railway and the Southern Railway are also in the market for 10,000 tons of rails. The former is asking prices on 2,500 tons of steel tie plates.

Contracts for twelve new Brill-Westinghouse gas-electric cars have been placed by four railroads with the Westinghouse Electric and Manufacturing Co. The orders cal for four 70-ft. combination baggage and passenger cars for the Lehigh Valley, two standard 60-ft. cars for the Central of Vermont, two standard 60-ft. cars for the Pennsylvania, and four 60-ft. cars for the St. Louis & San Francisco. The four cars ordered by the Lehigh Valley, instead of the standard 250-hp. gas-electric generator unit, will be equipped with double units, giving each car 500 horsepower.

The Central Railroad of New Jersey has purchased 1,000 box cars, divided 400 each to Standard Steel Car and Bethlehem Steel Corporation and 200 to American Car and Foundry Co.

The Baltimore & Ohio bought 1,000 box cars, divided 500 each to Standard Steel Car and Bethlehem Steel Corporation.

The Tennessee Central purchased 275 miscellaneous freight cars from Pressed Steel Car Co.

The Chicago, Milwaukee & St. Paul has made a contract with the Pullman Co. to supply fifty-five new sleeping cars costing in all about $3,000,000. The new cars, which will be operated by Pullman, will be used on the St. Paul's two crack trains, the Olympian and the Pioneer Limited.

One of the outstanding advantages of alternating current generally used by large public utility companies in bringing electricity for light and power from waterfalls many miles distant is its economical transmission at high voltages for long distances.

This same advantage is present in the economical distribution of alternating current power along the main line of the New Haven Railroad. It has also been recognized by engineers that direct current motors for driving locomotives are more rugged in construction and more reliable in operation than alternating current motors. The new locomotives combine both these advantages.

Another feature of this combination will be that these locomotives, with the addition of a direct current control, can go advantageously from a railroad line which has adopted alternating current, onto the line of a railroad which has direct current in use, or vice versa.—*The Wall Street Journal.*

The Illinois Central has placed an order for 50 heavy locomotives with the Lima Locomotive Works. The engines are of 2-8-4 type, weighing 193 tons each, and with tender 321 tons each.

The American Locomotive Co. has received an order for six 163-ton Mikado locomotives for the Chicago, Indianapolis & Louisville.

News of the Automotive Industry

Confidence in the industrial outlook is indicated by expansion plans of the General Motors Corporation, which have been revealed recently in part by several separate announcements. Representing as they do the combined industrial and financial judgment on the future of the du Pont Morgan interests which control General Motors, these plans are of more than passing interest to the business world. While no official statement has been made of the total amount which the corporation plans to expend in the immediate future on further strengthening and expanding its position in the automobile and other fields, it is estimated that the total will be between $140,000,000 and $150,000,000, of which approximately 40 per cent will represent cash outlay for expanding plant facilities.

A new cut in the price of all models was announced on June 18 by the Ford Motor Co. The reduction ranges from $15 to $45.

The new schedule announced by the company, including self-starter and balloon tire equipment on all passenger models, and starter and front balloon tires on the truck chassis, follows:

Runabouts, $360; touring, $380; coupe, $485; tudor sedan, $495; fordor sedan, $545; chassis, $300; truck chassis, $325. The fordor sedan is cut $25 and the truck chassis $45.

The company reported that conditions throughout the country and prospects for summer and fall business, as reported by its agents, were excellent in spite of backward weather in some places.

The Reo Motor Car Co. is building a three-story addition to its plant in Lansing. The new unit, which is approximately 200 x 600 ft., will add about eight acres of floor space and will be completed by Sept. 10.

The Flint Motor Co.'s assembly plant at Flint, Mich., has been sold to the General Motors Corporation. It will be used in the manufacture of automobile bodies by General Motors, which has large properties at Flint, including the main manufacturing plants of the Chevrolet and Buick companies. It is understood that the consideration for the transfer of the plant amounted to $4,000,000.

The Flint company is one of the developments of W. C. Durant. It was said last week in behalf of the Durant interests that the transfer of the plant does not mean the discontinuance of the Flint line of automobiles. The cars will be manufactured at other plants.

Personals

SIDNEY CORNELL, consulting engineer, announces his removal from 80 Maiden Lane to 7 Dey St., New York City.

H. J. KOEHN, of Gregory, Mayer & Thom, has been elected president of the Detroit Purchasing Agents' Association.

E. E. MAIN has retired as president of the United States Bearings Co., of Indianapolis.

C. M. FINNEY, of New York, was elected president of the National Association of Cost Accountants at the annual meeting of that body in Atlantic City last week.

A. MILTON BUCK has joined the sales force of the Bridgeport Brass Co. He will live in Washington, covering the states of Maryland, Virginia, and West Virginia.

CHARLES V. ALLEN has been appointed treasurer and assistant secretary of the Westinghouse Electric International Co., to fill the vacancy left by the resignation of H. A. Carmichael.

E. L. JOLLS has joined the Detroit sales force of the New Britain Machine Co., of New Britain, Conn. He was formerly associated with the Packard and Marmon organization.

J. W. WELLER has been made general manager of the Acme Motor Truck Co. of Cadillac, Mich. Mr. Weller was for three years vice-president and factory manager of the Gray Motor Co. of Detroit.

A. E. HITCHENER, an executive of the main offices of the Westinghouse Electric and Manufacturing Co., has been promoted to the managership of the company's Los Angeles office. He succeeds K. E. Van Kuran.

S. DUNCAN BLACK, president of the Black & Decker Manufacturing Co., of Towson, Md., accompanied by W. G. Allen, sales supervisor, and E. D. Allmendinger, export manager, sailed for Europe on June 2. They will visit the Black & Decker branch offices in all the important industrial cities of the Continent.

CHARLES H. OVERCAMP, for several years manager of the San Francisco branch of Manning, Maxwell & Moore, Inc., of New York, has organized the Overcamp Machinery Co. and will handle the following lines in the coast territory: Shaw Crane Co., Boye & Emmes, Manning, Maxwell & Moore, Inc., Bignall & Keeler Machinery Works, Deitrick & Harvey, the Springfield Machine Tool Co., and the Hubbard Steel Foundry Co. Mr. Overcamp has established offices in the Rialto Bldg., San Francisco.

CHARLES C. PHELPS, 473 Getty Ave., Paterson, N. J., announces that he and Charles J. Schmid have been appointed metropolitan New York and northern New Jersey representatives for the Uehling Instrument Co. of Paterson, the Williams Gauge Co., of Pittsburgh, the Combustion Control Division of the A. W. Cash Co., of Decatur, Ill., and the National Boiler Protector Co. of Dayton, Ohio. Mr. Phelps still retains his former connection with Uehling as treasurer of that organization. Mr. Schmid was formerly the Boston representative of the Uehling Instrument Co.

Farrel Veterans Hold Annual Dinner

The Veterans' Association of the Farrel Foundry and Machine Co., of Ansonia, Conn., recently held its annual dinner. Although previous annual affairs of the association have been very much enjoyed, the recent dinner was considered by the ninety guests present as the best yet.

Following the repast, the long-time employees of the company listened to a very interesting talk by Charles F. Bliss, president of the concern. Mr. Bliss very forcibly brought out the fact that if the business of the world is to be carried on steadily there must be world peace. Rev. Franklin J. Kennedy was the principal speaker of the evening.

Among the officials of the Farrel Foundry and Machine Co. present at the dinner besides Mr. Bliss, were Franklin Farrel, Jr., first vice-president; George C. Bryant, secretary; Carl Hitchcock, assistant secretary; and Frederick M. Drew, Jr., assistant treasurer.

Business Items

The Graybar Electric Co., successor to the supply department of the Western Electric Co., will occupy new offices at Lexington Ave. and 43rd St., New York, as soon as that building is completed.

The Tool Equipment Sales Co. of 18 So. Clinton St., Chicago, has been appointed exclusive factory agent for the Threadwell Tool Co., of Greenfield, Mass. Stocks will be carried for the territories in Illinois, Wisconsin and eastern Iowa.

The Union Steel Products Co., of Albion, Mich., announces the purchase of the business and good will of the Blackledge Manufacturing Co., of Chicago. The Blackledge company has for years been identified with the development and marketing of shock absorbing devices.

The Master Electric Co., of Dayton, Ohio, has opened a branch office and salesroom at 1725 Brandywine St., Philadelphia, Pa. A complete stock of motors will be carrried there. William F. Grau has been appointed manager.

The Soss Manufacturing Co., of Brooklyn, held its annual banquet on June 15. Joseph Soss, president of the company, was the toastmaster and during the course of the evening the prizes for the company's bowling tournament were presented to the winners.

Hubert K. Dalton of the Dalton Manufacturing Co., Sound Beach, Conn., has announced the sale of the company's property to the Magazine Repeating Razor Co., of Bridgeport, and Newark, N. J. The latter plants will be consolidated at the Sound Beach location. The Dalton company, makers of lathes, recently acquired a plant in New York.

The Reed-Prentice Corporation is the new name selected for the Reed-Prentice Co., at a meeting of the stockholders last week. The plan of reorganization has been accepted by all concerned. The active management has been strengthened by the addition of C. L. Stevens as vice-president in charge of operations; A. W. Schneider as works manager; and R. C. Blackinton as chief engineer. C. H. Carswell is retained as treasurer, and F. W. McIntyre as vice-president in charge of sales. The board of directors of the new corporation will be identical with that of the old company.

The Mechanics Supply Co. has been organized by Thomas B. Finlay, with offices at 519 Miami Bank and Trust Bldg., Miami, Fla. Mr. Finlay is well known in the machinery and factory equipment trade in the South, having been the representative in that territory for many years for several prominent manufacturers. Associated with Mr. Finlay in this new enterprise is Leslie R. Acton and J. R. A. Barnes. The former was at different times with the Studebaker Corporation, Maxwell Motors and the Redden Motor Truck Co. Mr. Barnes has for several years been associated with the automotive industry in Detroit.

The Alloy Cast Steel Co., of Marion, Ohio, has recently been organized by John D. Owens, C. A. Owens, M. C. McNeil H. J. Barnhart, Frank D. Glosser, Walter A. Dorsey, and E. J. Schoenlaub all of Marion. The company has purchased the electric steel foundry of the Fairbanks Steam Shovel Co., which was recently sold at receivers sale. The plant is now being overhauled and enlarged to a capacity of 400 tons of steel castings per month. Additions of modern foundry equipment will be installed. The new company will manufacture high grade electric steel castings in carbon, manganese and other alloy steel.

Obituaries

STANLEY M. LAWSON, president of the National Brass Manufacturing Co., of Cincinnati, died suddenly at his home in that city on May 28. He was 61 years old.

ROYALL VICTOR, member of the firm of Sullivan & Cromwell, of New York, and a director of Manning, Maxwell & Moore, Inc., died suddenly on May 30.

RICHARD NORRIS, one of the earliest manufacturers of locomotives in this country, died at his home in Philadelphia on June 16. He was 65 years old and had retired from business several years ago.

AUGUSTUS B. SEELIG, vice-president and general manager of the Michigan Copper and Brass Co., died recently at the Harper Hospital in Detroit following a brief illness. Mr. Seelig was 49 years old and had spent the greater portion of his life with the Chase Rolling Mills, of Waterbury, Conn., rising to the position of secretary and sales manager before he came to Detroit.

URI T. HUNGERFORD, chairman of the board of directors of the brass and copper manufacturing company which bears his name, died at his home in New York on June 17. He was 84 years old. His father is given credit for building the first brass foundry in Connecticut in 1834. He started his own company in New York in 1895 and had been active in its management until very recently.

Forthcoming Meetings

American Society for Testing Materials. Haddon Hall Hotel, Atlantic City, N. J., June 21 to 25. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Society of Mechanical Engineers. Spring meeting, Palace Hotel, San Francisco, Calif., June 28 to July 1. Chairman of convention, Warren H. McBride the California and Hawaiian Sugar Refining Co., 215 Market St., San Francisco.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 1, 2 and 3. G. G. Macina, secretary, 11402 Calumet Ave. Chicago.

American Railway Tool Foremen's Supply Association. Annual exhibit in connection with the annual convention of the American Railway Tool Foremen's Association, Chicago, Sept. 1, 2 and 3.

Machine Tool Exhibit. Sixth annual exhibition of machine tools at the Mason Laboratory, Yale University, under the auspices of the New Haven Section, A.S.M.E., the mechanical engineering department of the Sheffield Scientific School, and the New Haven Chamber of Commerce, Sept. 7 to 10. Administrative office, New Haven Machine Tool Exhibit, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual production meeting, Hotel Sherman, Chicago, Sept. 21, 22 and 23. John Warner, manager of meetings department, 29 West 39th St., New York.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under the auspices of the American Foundrymen's Association. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

The Weekly Price Guide

Rise and Fall of the Market

PRICES are firm with upward tendencies in plates and bars. Movement of tin plates, steel pipe and material for automotive and agricultural implement manufacture is brisk. Weakness in market for steel sheets continues with downward trend in prices. Mill quotations dropped 10c. on blue annealed, 25c. on black and 30c. per 100 lb. on galvanized steel sheets during the past week. Pittsburgh mill prices on the principal hot-rolled products are: bars, $2 per 100 lb. in carload lots or better; shapes and plates, $1.90 per 100 lb., f.o.b. Pig iron declined $1 per ton at Cincinnati, New York, Chicago and Pittsburgh, during the week. Almost all the non-ferrous metals are firmer, compared with the June 11 levels; antimony continues to fluctuate.

(All prices as of June 18)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	23.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	28.67
Basic	22.26
CHICAGO	
No. 2 Foundry local	22.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.27
Basic	20.27
Bessemer	20.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30@2.40	3.89	3.15	3.50
No. 12	2.35@2.45	3.94	3.20	3.55
No. 14	2.40@2.50	3.99	3.25	3.60
No. 16	2.50@2.60	4.09	3.35	3.70
Black				
Nos. 18 to 20	2.80@3.05	4.30	3.65	3.90
Nos. 22 to 24	2.85@3.10	4.35	3.70	3.95
Nos. 26 and 27	2.90@3.15	4.40	3.75	4.00
No. 28	3.00@3.25	4.50	3.85	4.10
Galvanized				
No. 10	3.20@3.40	4.65	4.00	4.25
Nos. 12 to 14	3.30@3.50	4.75	4.10	4.35
No. 16	3.45@3.65	4.90	4.25	4.50
Nos. 18 to 20	3.60@3.80	5.05	4.40	4.65
Nos. 22 to 24	3.75@3.95	5.20	4.55	4.80
Nos. 26 and 27	3.90@4.10	5.35	4.70	4.95
No. 28	4.20@4.40	5.65	5.00	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	58%	45%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	55%	42%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60@65%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ¼, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 3/16@½-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.40
Tin, 5-ton lots, New York			63.50
Lead (up to carlots) E. St. Louis	8.15	New York	9.00
Zinc (up to carlots) E. St. Louis	7.15	New York	8.12½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot.	13.00	13.50	11.00
Copper sheets, base	22.50	22.50	22.50
Copper wire, base	19.25	16.50	16.00
Copper bars, base	22.12½	22.12½	21.87½@22.12½
Copper tubing, base	24.25	24.25	24.25
Brass sheets, base	18.87½	18.87½	18.87½
Brass tubing, base	23.50	23.50	23.50
Brass rods, base	16.62½	16.62½	16.62½
Brass wire, base	19.37½	19.37½	19.37½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	12.75	12.55	11.51
Solder (½ and ½), (case lots)	36.75	40.00	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	74.25
Commercial genuine, intermediate grade	54.00
Anti-friction metal, general service	30.50
No. 4 babbitt (f.o.b.)	13.62½

Nickel, f.o.b. refinery, cents per lb.:

Ingots..... 31.00 Electrolytic.. 38.00 Shot.....32.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.75 @12.00	11.25	11.25@11.75
Copper, heavy, and wire	11.00 @11.50	11.50	10.75@11.25
Copper, light, and bottoms	9.50 @10.00	9.75	9.75@10.25
Heavy lead	6.75 @ 7.12½	6.50	6.50@ 7.00
Tea lead	4.50 @ 4.75	5.00	5.50@ 6.00
Brass, heavy, yellow	7.00 @ 7.25	7.25	7.50@ 8.00
Brass, heavy, red	9.00 @ 9.50	9.50	8.75@ 9.25
Brass, light	5.75 @ 6.00	6.00	6.75@ 7.25
No. 1 yellow rod turnings	8.00 @ 8.50	8.00	7.75@ 8.25
Zinc	4.25 @ 4.75	4.00	4.25@ 4.75

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0.20
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.18	36.00 per M	16
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	3.60†	3.35	4.25‡
Linseed oil, per gal., 5 bbl. lots	.89½	.96	92
Lard cutting oil, 25% lard, per gal.	.55	.50	48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs. † Per 150 lb. lot. ‡In 425 lb. barrels

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1662½	.1662½	.1587½
Solder (½ and ½)	per lb.	.3675	385	.395
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	55	.55	.55
Machine oil	per gal.	35	35	35
Belting, leather, medium	off list	40–5%	40–5%	30–10%
Machine bolts up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton	2.75@ 3.00	
Coke, prompt foundry, Connellsville	per net ton	4.00@ 4.50	
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16.75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x⅝-in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for ⅜-in and smaller and 65% for ½-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2¼-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, ⅞x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb for 1½ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅜-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ga., LaGrange—LaGrange Iron Wks., L. G. Schaudies, Pres.—complete equipment for proposed foundry and machine shop. Estimated cost $15,000.

Ill., Chicago—Dept. of Public Works, A. A. Sprague, Comr., will receive bids until June 30 for one 18 in. x 10 ft. quick-change engine lathe.

Ill., Cicero — Chicago Steel Tank Co., 1301 South 55th St.—equipment including benders, shears, punches, etc. (later) for the manufacture of steel tanks for proposed 1 and 2 story, 100 x 200 ft. factory. Estimated cost $175,000.

Minn., Minneapolis—Continental Machine Co., 1301 Washington Ave. S.—two power punch presses for forming ⅛ to ½ in. metal.

N. Y., Brooklyn—Hart Mfg. Co., 30 Degraw St., A. Walters, Purch. Agt., (shields and badges)—tie rod geared power press, about 100 ton pressure.

O., Portsmouth—Portsmouth Auto Sheet Metal Works, Union St., H. W. Elliott, Gen. Mgr.—metal working equipment for proposed 1 story, 25 x 87 ft. factory. Estimated cost $50,000.

Que., Rigaud — J. Lefelore — general foundry equipment.

Que., Ste. Claire—I. Morin—drill press, shaper, etc., for machine shop.

Que., St. Evariste Station—Pierre Pepin—general foundry equipment.

Australia, Melbourne—Victorian Government Railways—laminated spring lathe finishing press.

Opportunities for Future Business

Ala., Birmingham—Continental Gin Co., Title Guarantee Bldg., manufacturers of cotton gin machinery, awarded contract for improvements to plant.

Calif., Los Angeles—Calla Lily Dairy Co., c/o Pozzo Construction Co., 421 Macy St., Contrs., awarded contract for the construction of addition to plant including a 25 x 420 ft. machine shop, etc., on San Fernando Rd.

Fla., Tampa — Coates Plumbing Supply Co., 312 Washington St., had plans prepared for the construction of a 5 story factory including a department for pipe fitting, cutting, threading, etc. Estimated cost 150,000. F. J. James, Citizens' Bank Bldg., Archt.

Ill., Chicago — Chicago Rock Island & Pacific Ry. Co., La Salle St. Station, will soon award contract for the construction of a 1 story, 60 x 120 ft. mechanical and repair shop on 124th St., Burr Oak. Estimated cost including equipment $35,000. C. A. Morse, Ch. Engr.

Ill., Coal City—Somerville Machine Co. is considering rebuilding portion of plant recently destroyed by fire. Loss is estimated at $60,000.

Ill., National City — United States Can Co., 2510 Highland St., Norwood, Cincinnati, manufacturers of cans for packing and canning, has acquired a site and plans the construction of a factory here.

Ill., Quincy—Gardner Governor Co., manufacturers of engine governors, etc., will soon receive bids for the construction of a 1 story, 100 x 250 ft. addition to plant. Estimated cost $65,000. F. D. Chase Inc., 720 North Michigan Ave., Chicago, Archt. and Engr. Noted Dec. 17, 1925.

Md., Baltimore—Baltimore Motor Terminal Co., E. Williams, Pres., Hearst Tower, plans the construction of a 10 story garage at Center and St. Paul Sts. Estimated cost $700,000. C. H. Crane and K. Franzheim, 345 Madison Ave., New York, N. Y., Archts.

Mass., Cambridge (Boston P. O.)—Washington Auto Trust, D. M. Robb, 1800 Massachusetts Ave., is receiving bids for the construction of a 1 story repair and service garage. Estimated cost $40,000. J. A. Quirk, 10 Tremont St., Boston, Archt.

Mass., Malden (Boston P. O.)—Malden Electric Co., 200 Devonshire St., Boston, is receiving bids for the construction of a 2 story, 60 x 135 ft. garage and repair shop at 47 Canton St., here. Estimated cost $75,000. C. H. Tenney, 200 Devonshire St., Boston, Archt.

Mass., Medford (Boston P. O.)—Medford Center Garage, H. Risman, Prop., plans the construction of a 2 story garage and repair shop. Estimated cost $80,000. Architect not selected.

Mass., Williamsett—B. F. Perkins & Son, Inc., Holyoke, manufacturers of paper mill machinery and parts, had plans prepared for the construction of addition to press shop here. Lockwood, Greene & Co., 24 Federal St., Boston, Archts. and Engrs.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Mich., Pontiac — General Motors Corp., Oakland Motor Car Branch, plans the construction of a 2 story, 50 x 2,000 ft. assembly plant, 375 x 700 ft. motors building, 450 x 900 ft. car storage building, etc. Estimated cost $5,000,000. Private plans.

Mo., Nevada—Missouri Pacific R.R. Co., Railway Exchange Bldg., St. Louis, is having plans prepared for the construction of a 50 x 100 ft. addition to round house and machine shope here. Estimated cost $120,000. E. A. Hadley, St. Louis, Ch. Engr.

N. Y., Albany — F. Braun & Son, 376 Broadway, has work under way on the construction of a 2 story, 139 x 165 ft. garage on Hamilton St. Estimated cost $150,000.

N. Y., Brooklyn—Bullar-Murtha Motor Co., Inc., c/o H. Holder, 242 Franklin Ave., Archt., will soon receive bids for the construction of a repair and service garage on Quentine Rd. Estimated cost $200,000.

N. Y., Brooklyn—Philip H. Gill & Sons, Lorraine, Otsego and Cramer Sts., plan to rebuild a portion of machine shop destroyed by fire. Estimated cost including equipment $25,000.

N. Y., Long Island City — Steinway & Son, 109 West 57th St., New York, manufacturers of pianos, awarded contract for the construction of a 5 story factory at Ditmas Ave., here. Estimated cost $750,000.

O., Akron—Park-Union Co., H. H. Camp, plans the construction of a 2 story garage at Park and Union Sts. Estimated cost $150,000.

O., Ashland—Dept. of Public Works & Highways, G. P. Schlesinger, Dir., Columbus, is having sketches made for the construction of a 1 story, 80 x 120 ft. garage here. Estimated cost $50,000. H. B. Briggs, Ohio-Hartman Bldg., Columbus, Archt.

O., Cleveland—Bourne-Fuller Co., Hanna Bldg., manufacturer of bolts, nuts, reinforcing bars, etc., awarded contract for the construction of addition to factory at 1952 Scranton Rd.

O., Maysville—Ohio Pulley Co. had plans prepared for the construction of a 1 story, 60 x 300 ft. addition to plant. Estimated cost including equipment $50,000.

O., Movaine City (Dayton P. O.)—Delco-Light Co., Third National Bank Bldg., Dayton, manufacturers of Frigidaire machines, plans the construction of a 1 story, 210 x 2,400 ft., 1 story, 210 x 800 ft., and two 6 story, 80 x 500 ft. factory buildings here. Estimated cost $5,000,000. Schenk & Williams, Mutual Home Bldg., Archts. and Engrs.

O., New Philadelphia—Dept. of Public Works & Highways, G. F. Schlesinger, Dir., Columbus, is having sketches made for the construction of a 1 story, 80 x 120 ft. garage, here. Estimated cost $50,000. H. B. Briggs, Ohio-Hartman Bldg., Columbus, Archt.

O., Sidney — Dept. of Public Works & Highways, G. F. Schlesinger, Dir., Columbus, is having sketches made for the construction of a 1 story, 80 x 120 ft. garage, here. Estimated cost $50,000. H. B. Briggs, Ohio-Hartman Bldg., Columbus, Archt.

Pa., Philadelphia—John J. Nesbitt Inc., 213 North Vermont St., Atlantic City, N. J., manufacturer of ventilators, etc., awarded contract for the construction of a 1 and 2 story, 180 x 195 ft. plant here. Estimated cost including equipment $120,000.

Pa., Philadelphia — Philadelphia Rapid Transit Co., Ninth and Dauplin Sts., awarded contract for the construction of a 1 and 2 story, 290 x 500 ft. garage at Comly and Pennsylvania Sts. Estimated cost $180,000. Noted Apr. 20.

Pa., Philadelphia—C. H. Wheeler Mfg. Co., 19th St. and Sedgley Ave., manufacturers of surface condensers and auxiliaries, awarded contract for the construction of a 1 story machine shop.

Tenn., Nashville—O. F. Noel Estate, 53 Noel Blk., awarded contract for the construction of a 10 story, 100 x 175 ft. garage and repair shop at Seventh and Church Sts. Estimated cost $218,000.

Wis., Milwaukee—Atlas Metal Parts Co., 997 15th St., awarded contract for the construction of a 1 story, 60 x 124 ft. factory on 31st St. Estimated cost $40,000.

Wis., Racine—American Skein & Foundry Co., 2300 Racine St., awarded contract for the construction of a 1 story, 92 x 100 ft. addition to factory to be used for piano plate finishing room. Estimated cost $50,000.

Wis., Racine—Belle City Malleable Iron Co., Kewaunee St., awarded contract for the construction of a 2 story, 62 x 130 ft. addition to foundry. Estimated cost $45,000.

Man., Selkirk—Manitoba Steel Foundries Co., has work under way on the rebuilding of plant recently destroyed by fire. Estimated cost $150,000.

Vol. 64, No. 25 New York, June 24, 1926 25 cents a copy

American Machinist

KENNETH H. CONDIT and FRED H. COLVIN, *Editors*
L. C. MORROW, *Managing Editor* A. L. DeLEEUW, *Consulting Editor*
Editorial Staff: S. ASHTON HAND, ELLSWORTH SHELDON *(New England)*, W. E. IRISH, FRANK W. CURTIS *(Chicago)*, JOHN YOUNGER
GEORGE S. BRADY, FRANK J. OLIVER, JR., ARTHUR K. BURDITT, HENRY V. DOYLE, JR.
MASON BRITTON, *Manager*

Contents

Reducing Lost Time Accidents 967
By SANFORD DE HART.
Showing how a little time spent in instruction brings big returns.
American Machinist, Vol. 64.

Pacific Coast Railroad-Shop Methods 971
By FRANK A. STANLEY.
Work done by the draw-cut shaper; fitting tapers and broaching.
American Machinist, Vol. 64.

The Design of Gear Tooth Forms 973
By EARLE BUCKINGHAM.
The 14½-deg. basic-rack, variable-center system compared with conventional tooth forms. Range-cutter, proportional-center system.
American Machinist, Vol. 64.

The Screw Conveyor and Its Manufacture 977
By D. C. WRIGHT.
The second article. Operations on flight sections.
American Machinist, Vol. 64.

Picture Pages 981

Fixtures and Methods of Machining Hupp Cylinders 985
By FRED H. COLVIN.
Methods differing from the usual in building six-cylinder engines.
American Machinist, Vol. 64.

Miscellaneous Articles

The Relation of Load to Wear on Gear Teeth—Discussion, Buckingham 969
A Comparison of Drawing Methods—Discussion, Swenson 970
Seen and Heard, Godfrey 970
Is There Anything the Matter With Engineering Education? Entropy 972
Turret Tooling for Transmission Levers, Yeomans 976
Does the Draftsman Co-operate With the Machine Shop? Davies 980
Blueprints from Blueprints, Hardecker 980
American Machinist, Vol. 64.

Ideas from Practical Men 989

Reference-Book Sheet 993

Practical Shop Problems 994

Technical Abstracts 995

Editorials 996

Shop Equipment News 997

News Section 1004a

The Business Barometer 1004d
By THEODORE H. PRICE.

Weekly Price Guide, Shop Materials and Supplies 1004h and i

Machine Requirements and Industrial Construction 1004j

Travel—
visit other shops—
yet stay at home

"I WISH I had your opportunity to see methods in shops all over the country." So said a foreman to an "American Machinist" editor in the field.

Now that foreman—and everyone else concerned with methods—does have just that opportunity. The editors spend from a third to two-thirds of their time in the field to see for the men who can't take time away from their jobs to travel. The information gathered is duly reported in the "American Machinist."

It's good for a man to have a change once in a while—therefore to travel. But the men in the shop, and the men at the head of the shop, actually have agents traveling for them, sifting out the best methods and laying reports on their desks weekly. Those agents are the editors and the reports are the "American Machinist" itself.

McGRAW-HILL PUBLISHING COMPANY, INC.
Tenth Ave. at 36th St., NEW YORK, N. Y.

WASHINGTON, Colorado Building
CHICAGO, 7 S. Dearborn St.
PHILADELPHIA, 16th and Parkway
CLEVELAND, Guardian Building
ST. LOUIS, Star Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E.C.4

JAMES H. McGRAW, President
JAMES H. McGRAW, JR., Vice Pres. and Treas.
MALCOLM MUIR, Vice-President
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
C. H. THOMPSON, Secretary

Annual subscription rate, $5 in any part of the United States, Canada, Mexico, Alaska, Hawaii, the Philippines, Porto Rico, Canal Zone, Cuba, Haiti, Panama, Dominican Republic, Honduras, Salvador, Nicaragua, Peru, Colombia, Bolivia, Ecuador, Argentina, Brazil, Chile, Spain, Uruguay, Costa Rica, Guatemala and Paraguay. Extra postage on American Edition in other countries except Europe and British possessions in Eastern Hemisphere, $4 (total $9 or 28 shillings). Single copy, 25 cents. McGraw-Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C. 4, England, will serve with the European edition subscribers in Europe and British possessions in Eastern Hemisphere (25 shillings for England and elsewhere in Eastern Hemisphere).

Publishers of
American Machinist — Engineering News-Record
Power — Chemical and Metallurgical Engineering
Coal Age — Engineering and Mining Journal-Press
Ingeniería Internacional — Radio Retailing
Bus Transportation — Electric Railway Journal
Electrical World — Electrical Merchandising
Industrial Engineer — Successful Methods

Journal of Electricity
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

Change of Address — When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before the change takes place.

Copyright 1926
By McGraw-Hill Publishing Company, Inc.

Published weekly

Entered as second-class matter June 23, 1879, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Member Associated Business Papers, Inc. Member Audit Bureau of Circulations
Average number of copies per issue printed during month of May, 18,194

The Steam Shovel

There isn't a trick of the shovel or pick
That the mighty steam shovel can't do,
And its labor is done by the yard and the ton
With a couple of men for its crew.
It can finish a job that a laboring mob
Would sweat over, *months*—in a day.
It's a glutton for toil in all manner of soil,
In the gravel, the sand and the clay.

'Twas the steam shovel which dug the Panama ditch,
And great mountains of dirt it has hurled
From the path of mankind. It's a tool you will find
All over the face of the world.
Yes, its work is immense and its price twenty cents
By the pound. It's a cheap enough price
When you think of the fret and the labor and sweat
That is saved by this magic device.

Machine tools have made it, and, but for their aid, it
Would never be able to dig.
It wouldn't be found eating acres of ground
In mouthfuls exceedingly big.
Yet Machine tools that take the hard metal and make
Steam shovels—and other things too,
Sell, weight matched with weight, for about the same rate
That the roughly made steam shovels do.

BUT—when you buy machine tools, their worth is proved to you,
Not merely by the price per pound, but by the *work* they do!

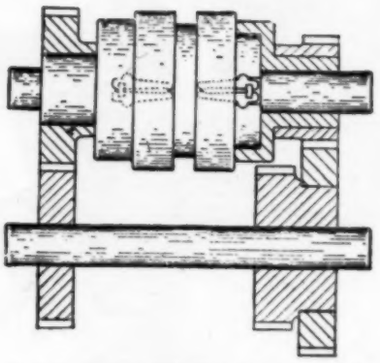
Modern Equipment
Cuts Costs

NATIONAL
MACHINE TOOL BUILDERS
ASSOCIATION

THE JOHNSON FRICTION CLUTCH

As Used on the

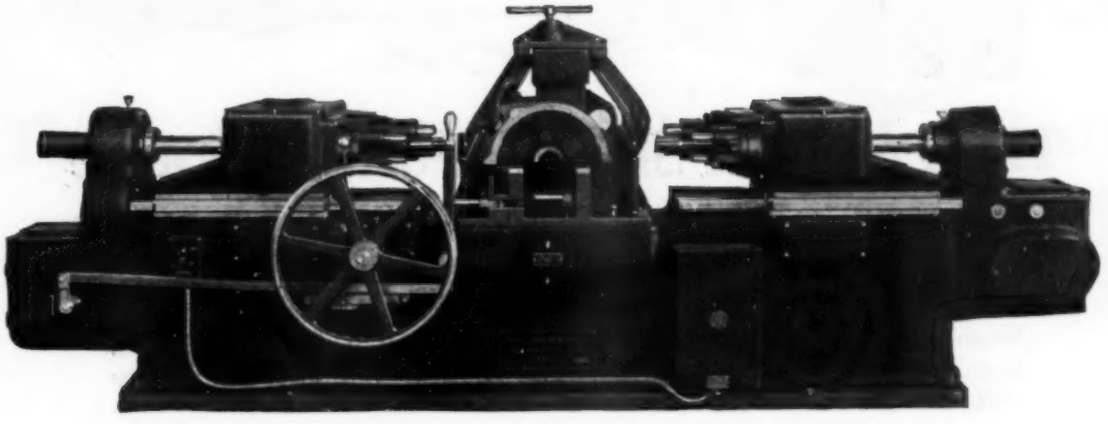
Barnes Duplex Horizontal Drilling and Tapping Machine



No. 5 Johnson Double Clutch as used in the gear box of the Barnes machine.

A No. 5 Special Double Johnson Friction Clutch with spur gears mounted on the clutch hubs is used in reversing this Barnes machine for tapping.

Double Clutch—Exterior



Courtesy: The W. F. and John Barnes Company, Rockford, Ill.

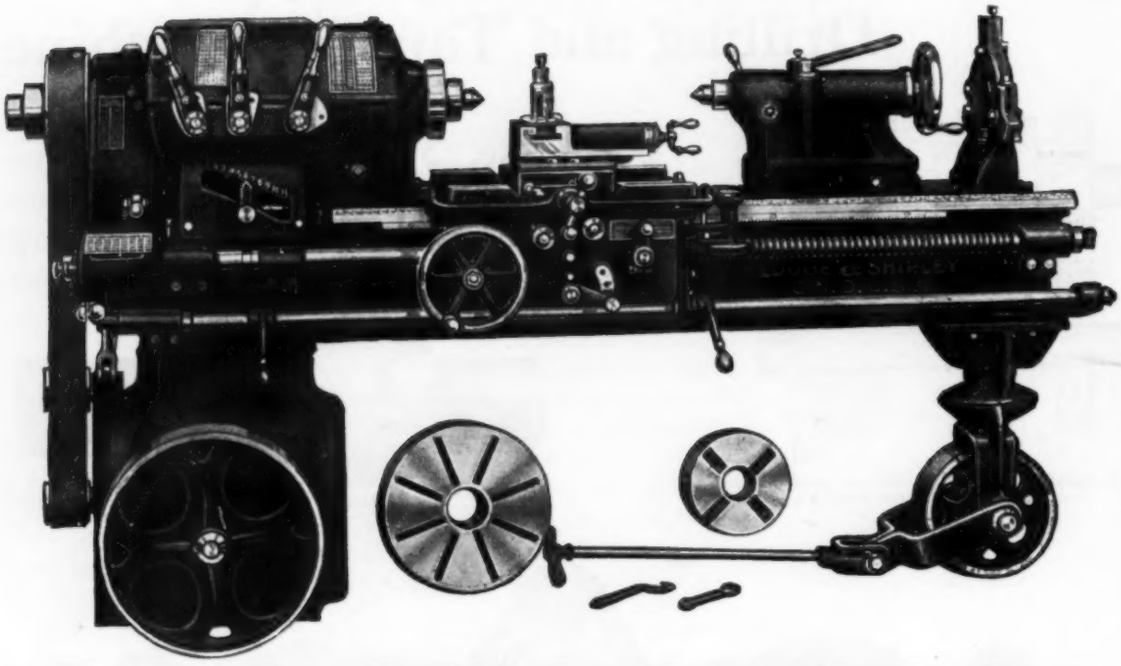
This useful counterboring and tapping machine is doing excellent work for a nationally known automobile manufacturer. It is setting a record for high production, and the Johnson Clutch is playing an important part in this gruelling work. Sturdily built, high-powered, designed to stand up for years, Johnson Clutches meet every requirement on this Barnes Machine.

Johnson leadership in the clutch field is no accident. For twenty-four years our organization has concentrated on friction clutches alone. Skilled machinists and expert engineers have given the best that was in them to perfect the Johnson. The result is the clutch with the reputation known throughout America and Europe. Install Johnsons on your drilling and tapping machines.

Write for Blue Catalog

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

In many railroad shops the Lodge & Shipley



The Lodge & Shipley Portable Lathe

with Selective Headstock and Belted Motor Drive in Leg
Made in sizes 12 in. to 20 in.
Belt Guard included with regular equipment.

Where it is more convenient to take the lathe to the work, such as is frequently the case in railroad shops, the Portable Lathe is a very valuable tool.

On a fairly level floor one man can pull it around by himself. The lathe is arranged for mounting the motor in the head end leg and a switch is conveniently located on it.

Such a lathe is an asset to any shop where the work is of a peculiar nature and cannot conveniently be taken to the lathe in another department.

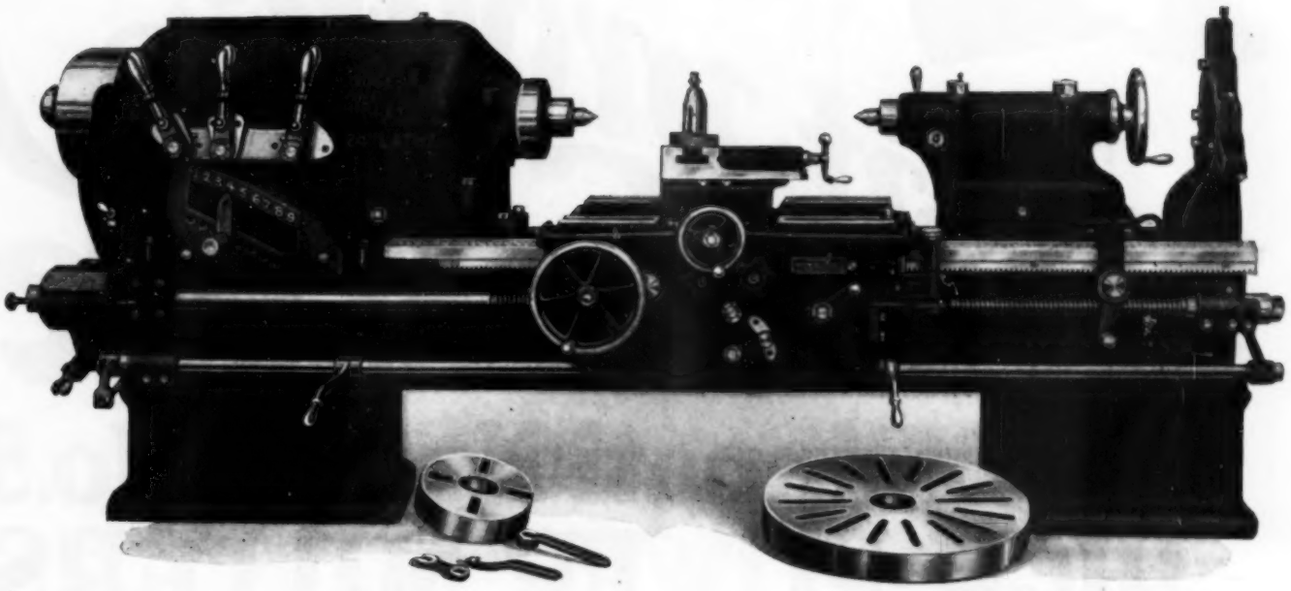
With a portable lathe the work can be done "on the spot."

Let us tell you more about
Lodge & Shipley Lathes

CINCINNATI
MAKES MORE MACHINE TOOLS IN ITS OWN CITY THAN ANY OTHER CITY IN THE WORLD
CINCINNATI

The Lodge & Shipley
Cincinnati,

shops—
Lathe is preferred!



The Lodge & Shipley Selective Head Lathe

Made in sizes 12 in. to 48 in.

Many railroad shops prefer Lodge & Shipley Lathes, first of all because they are a real investment. They are easy to operate; last an unusually long period of time and retain their accuracy during that time.

Railroads are gradually recognizing the fact that the price of a tool is not its cost. The big item — that of upkeep — is the thing that counts. A good tool for which they must pay more does not require the tremendous upkeep and can be used over a longer period of time than a cheaper machine.

They may pay more for a good lathe but in the long run it *costs* less. Ask the man who runs a Lodge & Shipley!

Send today for complete catalogue
No obligation.

Machine Tool Co.
Ohio

CINCINNATI

12 profit-producing features

on Cincinnati No. 4 and No. 5 HIGH-POWER MILLERS

Single Lever Feed Box
(Patented)

Complete Rear Control
(Patented)

Safety Device
(Patented)

Selective Sliding Gears for Speed Changes
(Patented)

Intermittent Feed
(Patented)

Square Gibbed Bearings and Narrow Guides

The Cincinnati Flanged Spindle End and No. 14 Taper Hole
(Patented)

Additional Features

Column bearings automatically oiled.
Stream lubrication for cutters and work.
Automatic brake for stopping spindle.

Five-Position Table Feed Lever
(Patented)

Spindle Reverse

Cutter Coolant Pump Capacity 11 Gallons per minute, Sliding gears for feed changes.

Rectangular Overarm
(Patented)

CINCINNATI MILLERS

PIONEERS!

These productive features on our No. 4 & 5 High Power Cincinnati Millers are unequalled.

For many years Railroad Shops, Automobile Plants and Electrical Manufacturers as well as other users of large Milling Machines have turned to us when installing this type of Miller.

We were pioneers in giving you these exclusive and patented features. By sending for our new book describing these machines you will get the whole story.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI · OHIO · U·S·A·

Ten acres devoted to the production of Milling Machines and Grinders exclusively.

CINCINNATI
MAKES MORE MACHINE TOOLS IN A LARGER VARIETY THAN ANY OTHER CITY IN THE WORLD
TO SEE ANY UP-TO-DATE MACHINE TOOL COME TO
CINCINNATI

CINCINNATI MILLERS

You can't hatch eagles from humming birds' eggs

Nor can you achieve great things from small ideas.

We determined to specialize on Drilling Machinery over fifty years ago, and set a pace that has proved too stiff for the field to follow.

The culmination of our efforts is here shown—the *Cincinnati Bickford Master Radial.*

It is a Colossus in power and range, yet is handled as smoothly and easily as a sensitive machine.

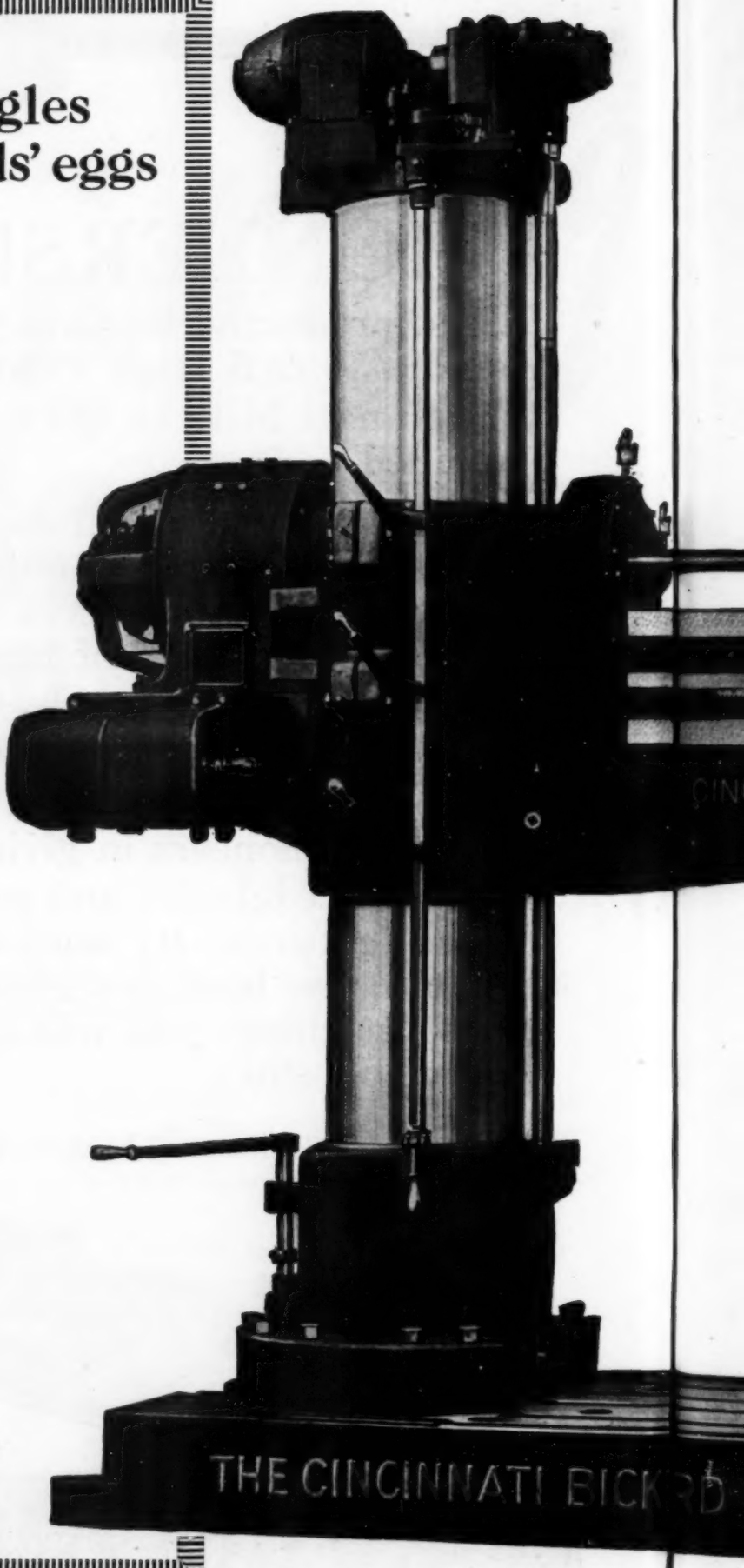
As to its producing ability; it will drive a 3-in. drill in 55-point steel at 101 revolutions and .025-inch feed. At this feed and speed the drill cuts seven times faster than common with the usual Carbon Drill, or 2.53 inches per minute.

The above is by no means its maximum—as the stamina of the cutting tool itself is the only limit to the productivity of the Master Radial.

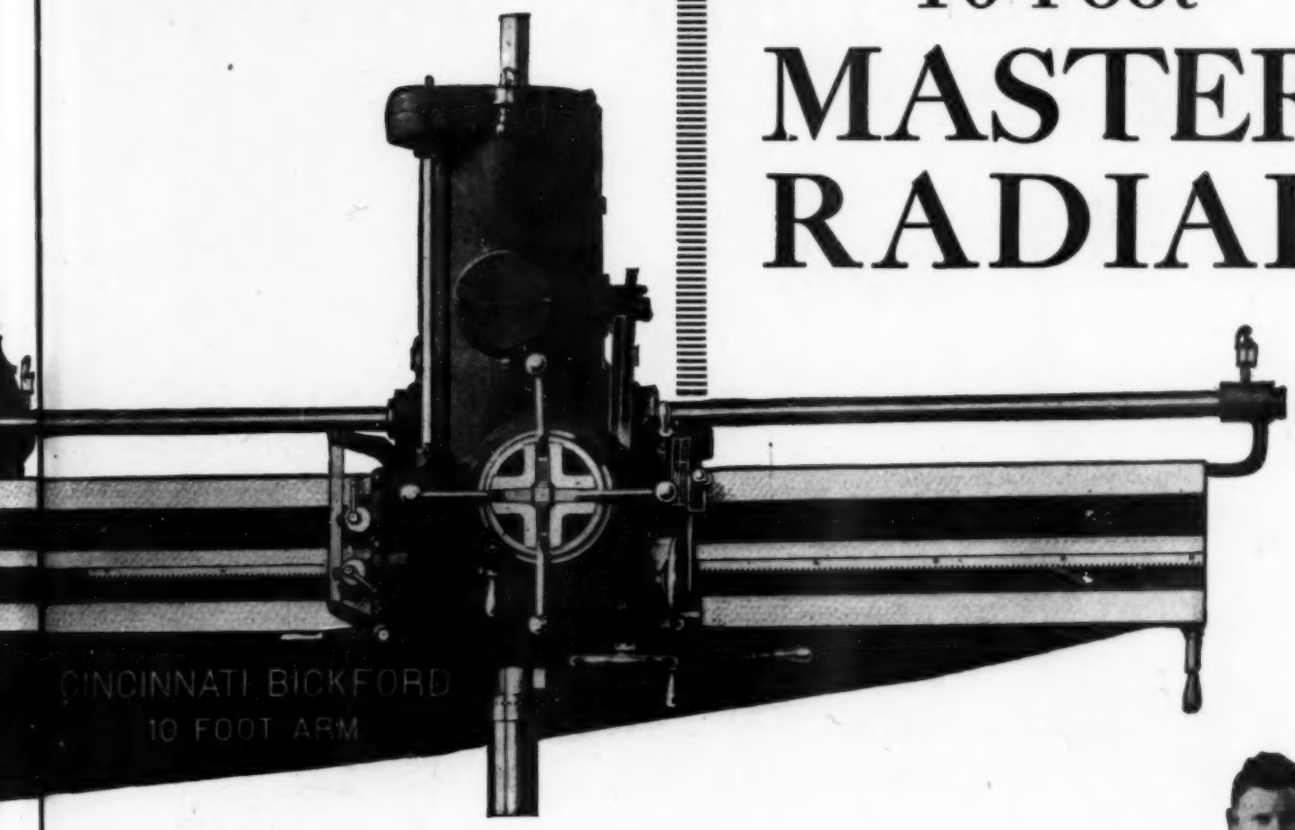
Let's talk performance.

FOUNDED IN 1874 GOING STRONGER THAN EVER

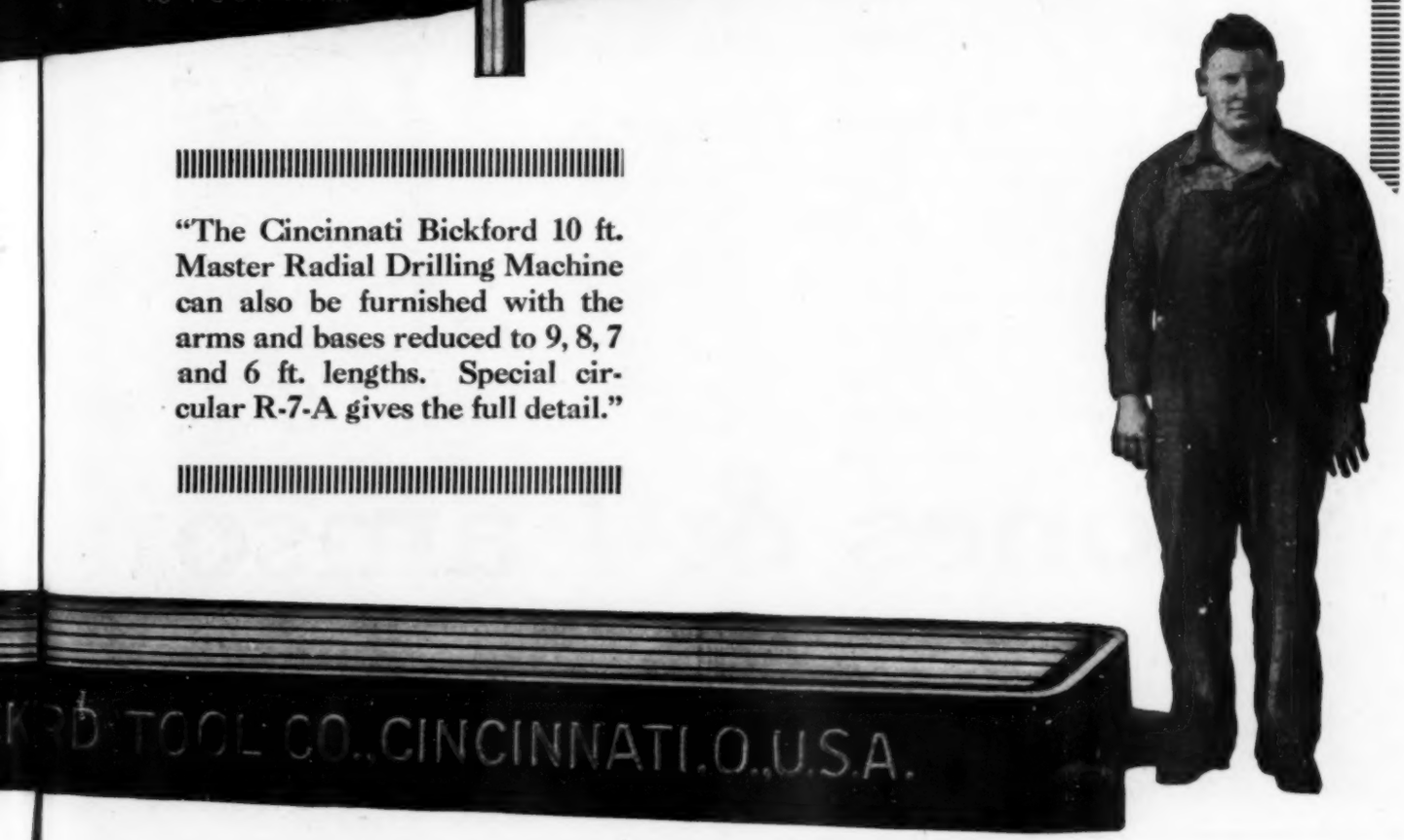
Modern Equipment Cuts Cost



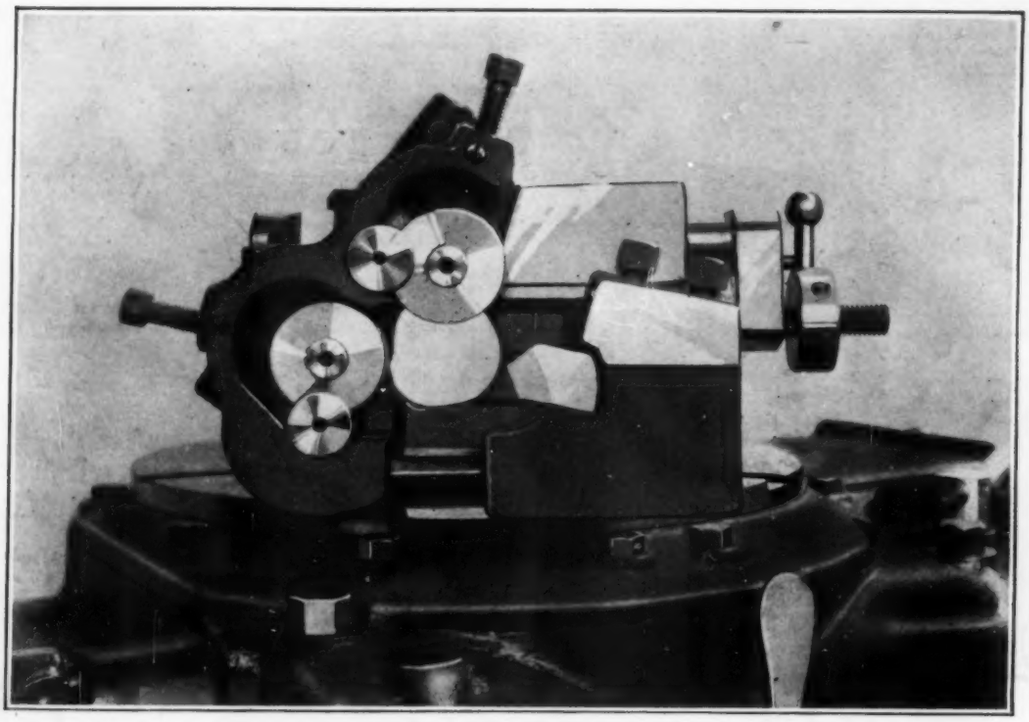
Cincinnati Bickford
10 Foot
MASTER RADIAL



"The Cincinnati Bickford 10 ft. Master Radial Drilling Machine can also be furnished with the arms and bases reduced to 9, 8, 7 and 6 ft. lengths. Special circular R-7-A gives the full detail."



J&L Hartness Flat Taper Turning Tools for



Taper Turner K

is designed primarily for tapers which must be held concentric with another cylindrical surface.

Its tool only is affected by the template held on the tailstock. It rolls commonly run ahead of the tool on a size previously turned straight, and so insure concentricity of the taper with that surface.

This turner will also turn tapers from the rough stock or forgings, or bar stock held in a flexible chuck without previous straight turning. When used in this way the rolls run behind the tool and the work is pushed off center in a way similar to cutting a taper on an engine lathe with the tail center moved over.

J&L Jones & Lamson

Springfield,

Hartness
Flat Turret Lathe

Fay
Automatic Lathe

Hartness
Double Spindle Flat Turret Lathe

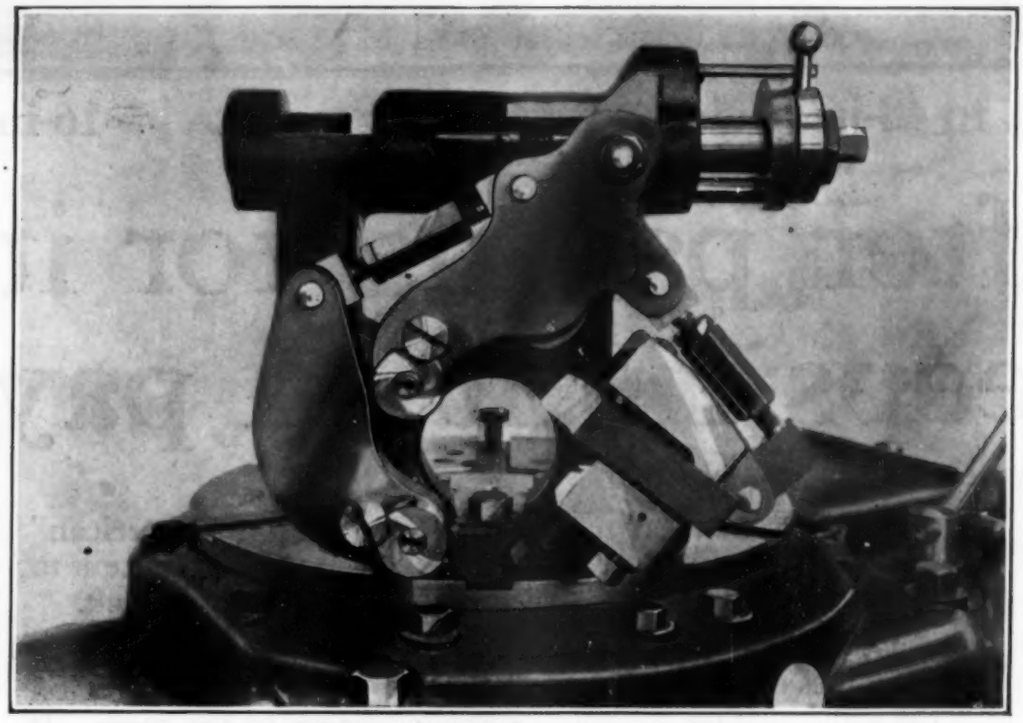
BRANCH OFFICES

SAN FRANCISCO, CALIFORNIA, 503 Market Street
LONDON, ENGLAND, 19-21 Water Lane, Queen Victoria Street
SPAIN, BELGIUM, SWITZERLAND, PORTUGAL and ITALY
Fenwick Freres & Co., 8 Rue de Rocroy, Paris, France
HOLLAND, Spliethoff, Beeuwkes & Co., Luevehaven, Wz., 159 Rotterdam

Turret Lathe

J&L
JONES & LAMSON

Bar Work are of Two Types



Taper Turner L

Also is actuated by a former from the headstock. The rolls run behind the tool, the tool and rolls being linked together, and all affected by the template. The template and rolls must be changed for each taper. This turner is the most economical metal remover for tapers turned in quantity which need not be concentric with previously turned sizes.

MachineCompany

J&L
JONES & LAMSON

Vermont, U. S. A.

BRANCH OFFICES:

GERMANY, M. Koyemann, m, b, H. Dusseldorf
JAPAN, KOREA, MANCHURIA, FORMOSA, Mitsui Co. Ltd., Tokio
FRANCE, Fenwick, Freres & Company, 8 Rue de Rocroy, Paris
C. E. Carpenter Co., 57 Rue Richelieu, Paris, France
AUSTRALIA, McPherson, Pty., Ltd., 554 Collins St., Melbourne

Hartness
Automatic Die
Flanders
Ground Tap
Hartness
Screw Thread Comparator

12-in. to 48-in. Swing **16-in. to 36-in.**

After paying for itself keeps right on paying

THE time-saving performance of the "American" Triple Purpose Radial Drill is such as to cause it to pay for itself in far less time than other equipment.

Not only does it do the work of two or more older type machines of the same size, but it does series hole drilling on the same surface without changing set-up of the piece. It also does all work with minimum operating effort.

The internal gear spindle drive is responsible for the "American's" remarkable success in boring and tapping. It is the only radial drill built that possesses this feature.

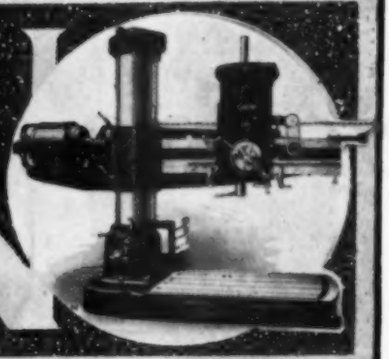
The smooth rolling contact between the gears imparts a smooth, steady action to the spindle. There is a greater area of tooth contact between the driving gears than on the ordinary external gear drive, consequently, the spindle is held much more rigidly against chatter and vibration.

"American" Triple Purpose Radials possess many more features that work directly for your benefit. They are all detailed in our late Catalog.

Modern Equipment Cuts Cost

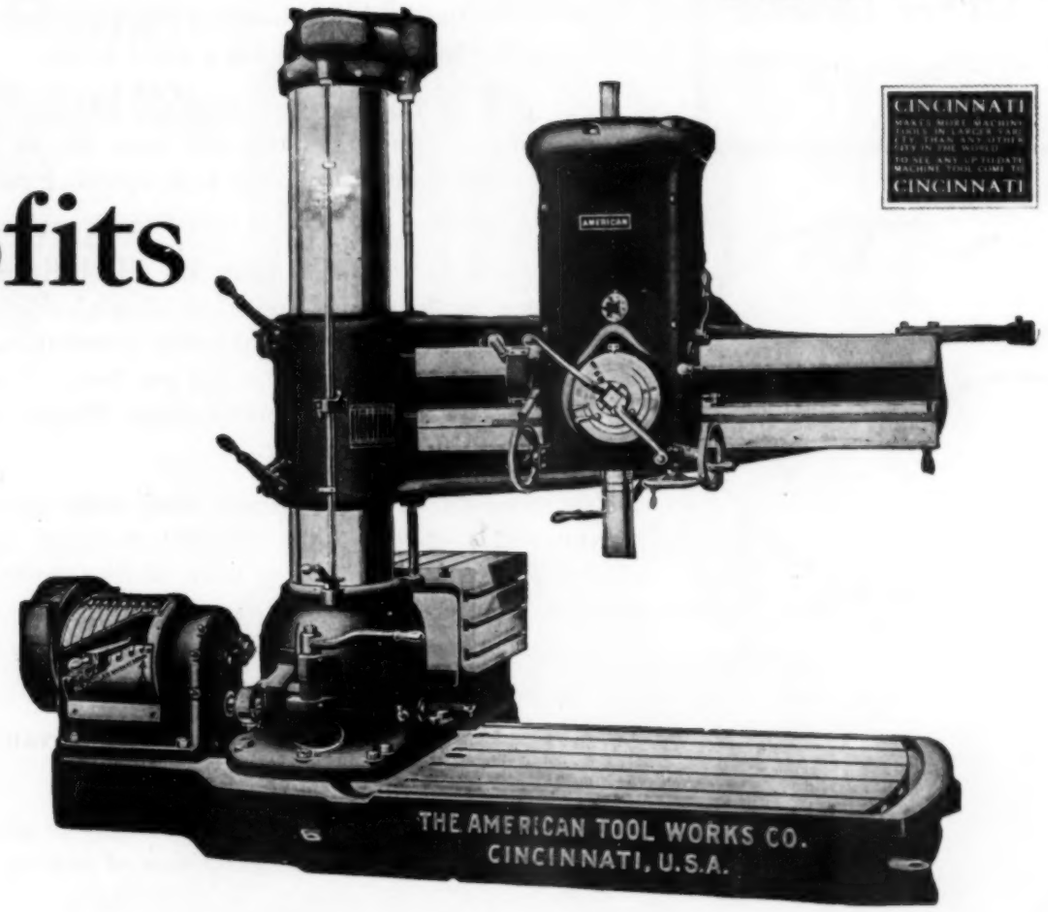
The American Tool Works

I CAN



Stroke **2-ft. to 10-ft. Arms**

—it profits

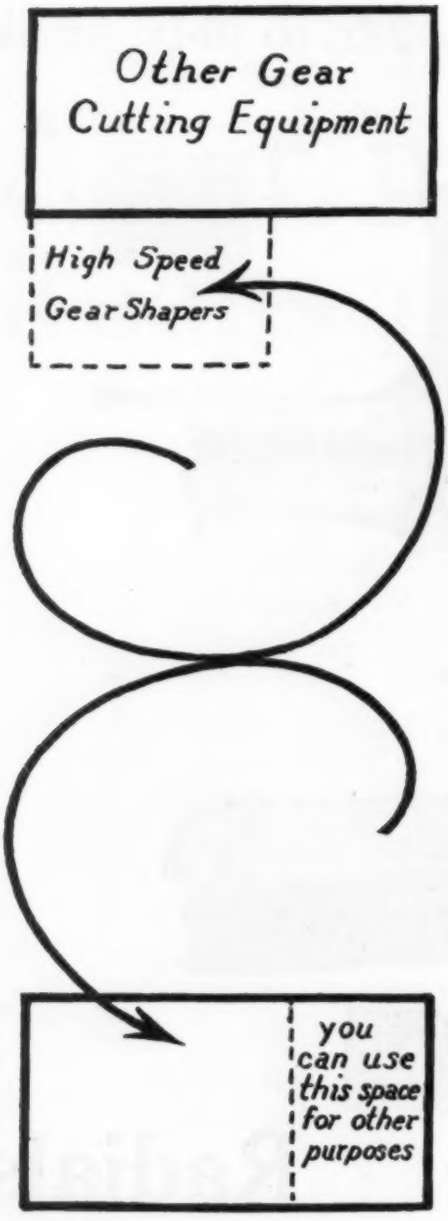

CINCINNATI
MAKES MORE MACHINE TOOLS IN LARGER VARIETY THAN ANY OTHER CITY IN THE WORLD
TO SEE ANY UP-TO-DATE MACHINE TOOL COME TO
CINCINNATI
AMERICAN
THE AMERICAN TOOL WORKS CO.
CINCINNATI, U.S.A.

AMERICAN

Lathes Shapers Radials

Company, Cincinnati, U.S.A.

So he decided not to



GEARS were not coming to the assemblers at the same rate as parts from other departments. The production man was called into conference with the super, manager and foreman.

The super and manager had about decided on an addition to the building housing the gear department, when the foreman asked for a word or two.

He pointed out the fact that the old gear cutting equipment couldn't stand the pace set by modern units. He showed where it took up more room than it was worth.

He gave facts and figures on High-Speed Gear Shaper performance in other shops. He showed where satisfaction followed every installation. Gears were better and more were cut per hour. Operating expense was low and every Gear Shaper had the good will of the operator.

As to new building expenses, they were unnecessary. The High-Speed Gear Shaper required one-third less floor space than other units of like capacity. He could get sixteen Gear Shapers in the space now occupied by twelve machines, and have plenty of operating and trucking room to spare.

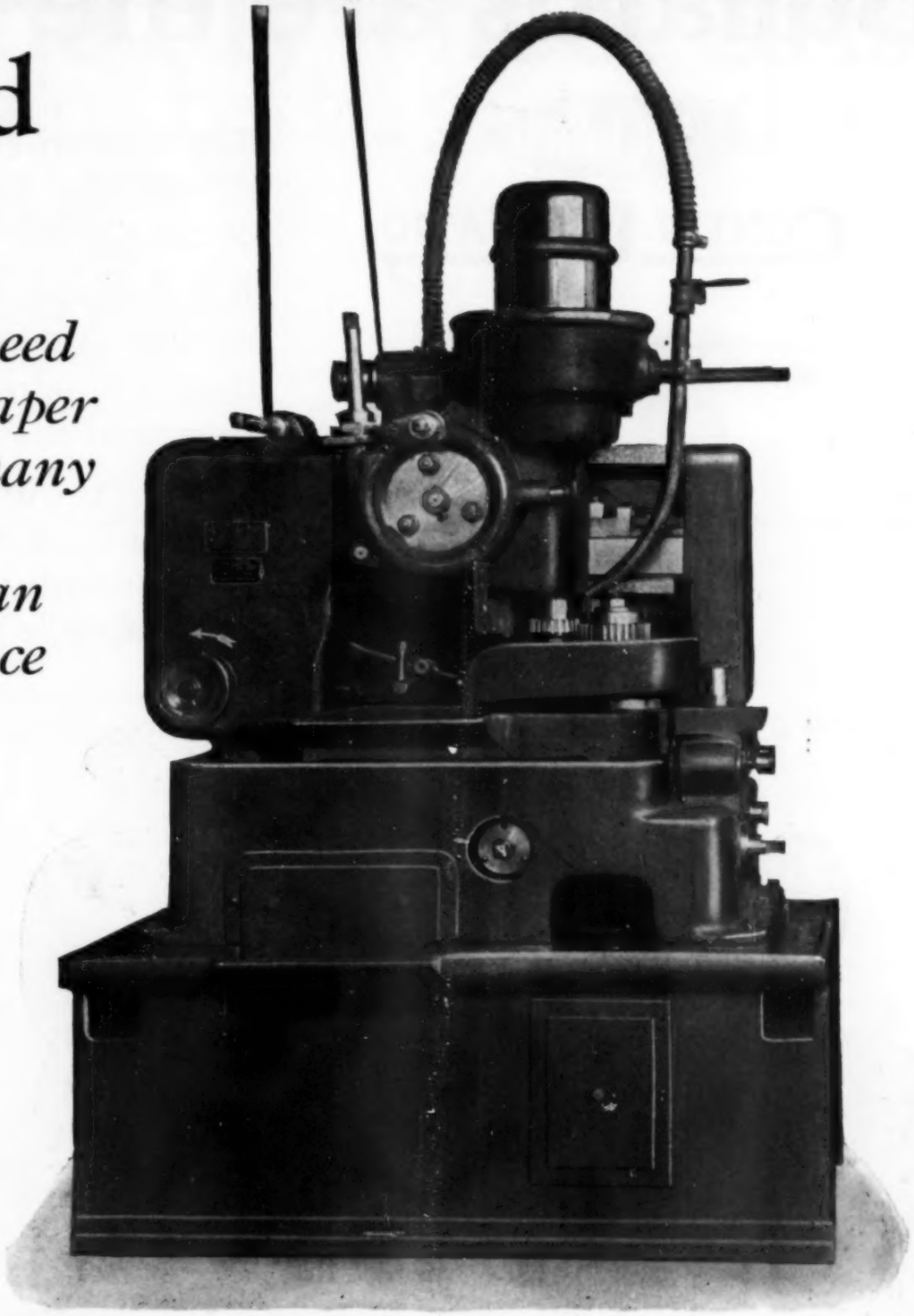
The super took the data, made a few private investigations—and the addition was not built.

The High-Speed Gear Shaper is easy to set up and operate. Changing from one size of gear to another is a matter of minutes—operators like it.

Accurate gears at low cost will "Put Money in Your Purse." Send for Booklet bearing this title and see how.

build

and the High-Speed Gear Shaper makes many savings other than floor space



THE FELLOWS GEAR SHAPER COMPANY

Head Office and Works: 78 River St., Springfield, Vermont, U. S. A.

Branch Office: 651 Book Bldg., Detroit, Mich.

FOREIGN AGENTS: Alfred Herbert, Coventry, England—Great Britain; Alfred Herbert (India), Ltd., Calcutta and Bombay—India; Alfred Herbert, Ltd., Osaka and Tokio—Japan and China; Alfred Herbert (Australasia), Ltd., Sydney—Australia; Societe Anonyme Alfred Herbert, Paris—France and Spain; Societa Anonima Italiana Alfred Herbert, Milan—Italy; Societe Anonyme Belge Alfred Herbert, Brussels—Belgium and Holland; Bohm & Borman, Berlin—Germany, Czecho-Slovakia and Austria; Aktiebolaget A. Bonthrom, Stockholm—Sweden, Finland and Norway; American Machinery Import Co., Zurich—Switzerland.

PACIFIC COAST REPRESENTATIVES: Louis G. Henes, 75 Fremont St., San Francisco, 1418 Santa Fe Ave., Los Angeles.

Bullards are the Mills

BULLARD

CONTIN-U-MATIC

The Contin-U-Matic has solved the flywheel machining problem.

It has proven its economy on lots ranging from less than a hundred a day up to several thousands.

Costs show that the Contin-U-Matic Method is consistently lower than single spindle methods.

Bullard Machine Tool Co.
Bridgeport, Conn., U.S.A.

for the Flywheel Grist

Quantity production, accuracy and costs—all are vital to the machining of automobile flywheels.

These three problems have been satisfactorily solved with the Contin-U-Matic Method.

It is a continuous machining process adapted to heavy cutting and simple tool combinations. It is adaptable to a wide range of requirements, viz.—one Four-Spindle Contin-U-Matic may be tooled to produce four distinct settings of the same piece.

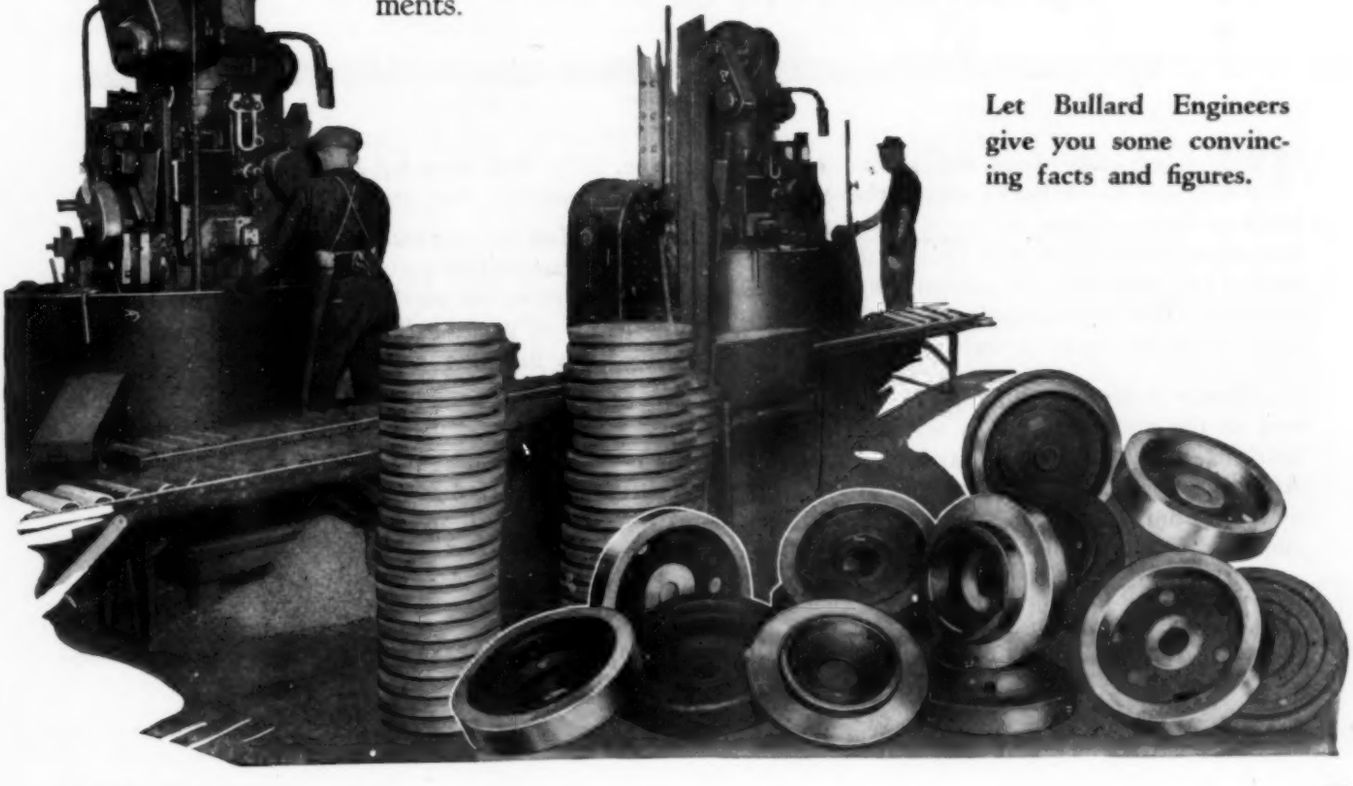
In battery formation either single unit type or double unit type of tooling will most nearly meet your conditions, depending on the volume of work.

85% to 90% of all Flywheels

in the automotive industry are produced by Bullards. They've been at it since the early days and have met the demands for peak output, close accuracy and low cost.

Where used, the Contin-U-Matic installations have paid for themselves in a short time.

Made in 4-unit, 2-unit and single-unit types to suit your requirements.

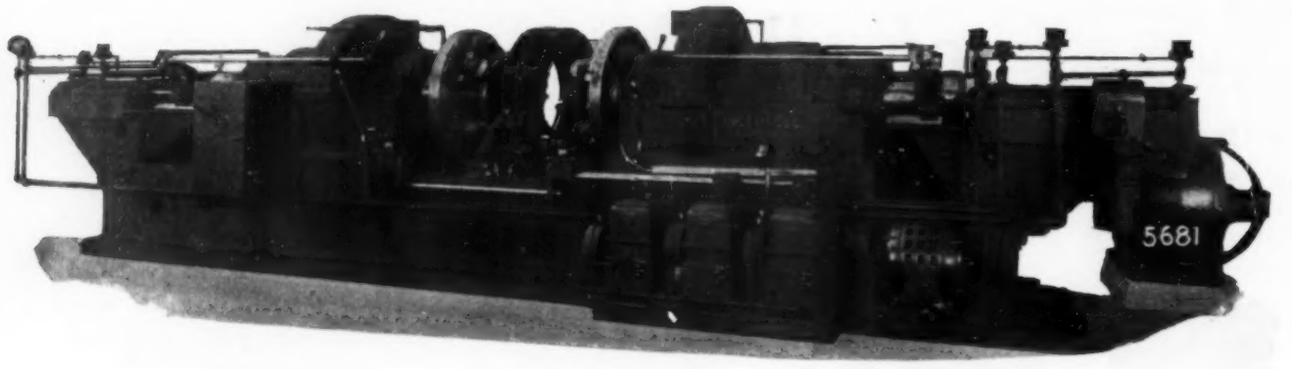


Let Bullard Engineers give you some convincing facts and figures.

Boring Machines

HEAVY DUTY TYPE
BUILT BY

Ingersoll



THE heavy-duty Ingersoll shown above rough and finish bores, counterbores and faces to depth sixteen different sizes of electric motor frames. It is a Duplex Machine, having two spindles, one within the other, at each end. The inner spindles carry the boring tools while the outer drive the facing heads.

The frame is first rough bored from one end, and as the roughing tool is withdrawn, the finishing spindle bores from the other end. After the finish bore, the frame is first rough and then finish faced to depth to a positive stop. The floor to floor time on the largest frame, 25½ inch bore by 26 inches long, is fifteen minutes.

The machine is twenty-two feet long and weighs about 60,000 pounds. All the gears are of heat-treated steel, enclosed and running in oil or grease. The rugged construction of the machine allows heavy cuts and fast feeds. It is equipped with hydraulic feed, each spindle fed by a different pump.

We may be able to help you with your boring problems. Let us have your blueprints and we will be glad to submit layouts and suggestions.

The Ingersoll Milling Machine Co.

Milling Machines and Their Equipment

ROCKFORD, ILL.

New Departure Quality Ball Bearings

Here's a Good Example
of what they will do for you

One of the chief difficulties with plain bearings is the proper retention of oil as a lubricant in *vertical* shafts.

When centrifugals are used for laundry purposes, there is the added danger of soiling the material in the basket.

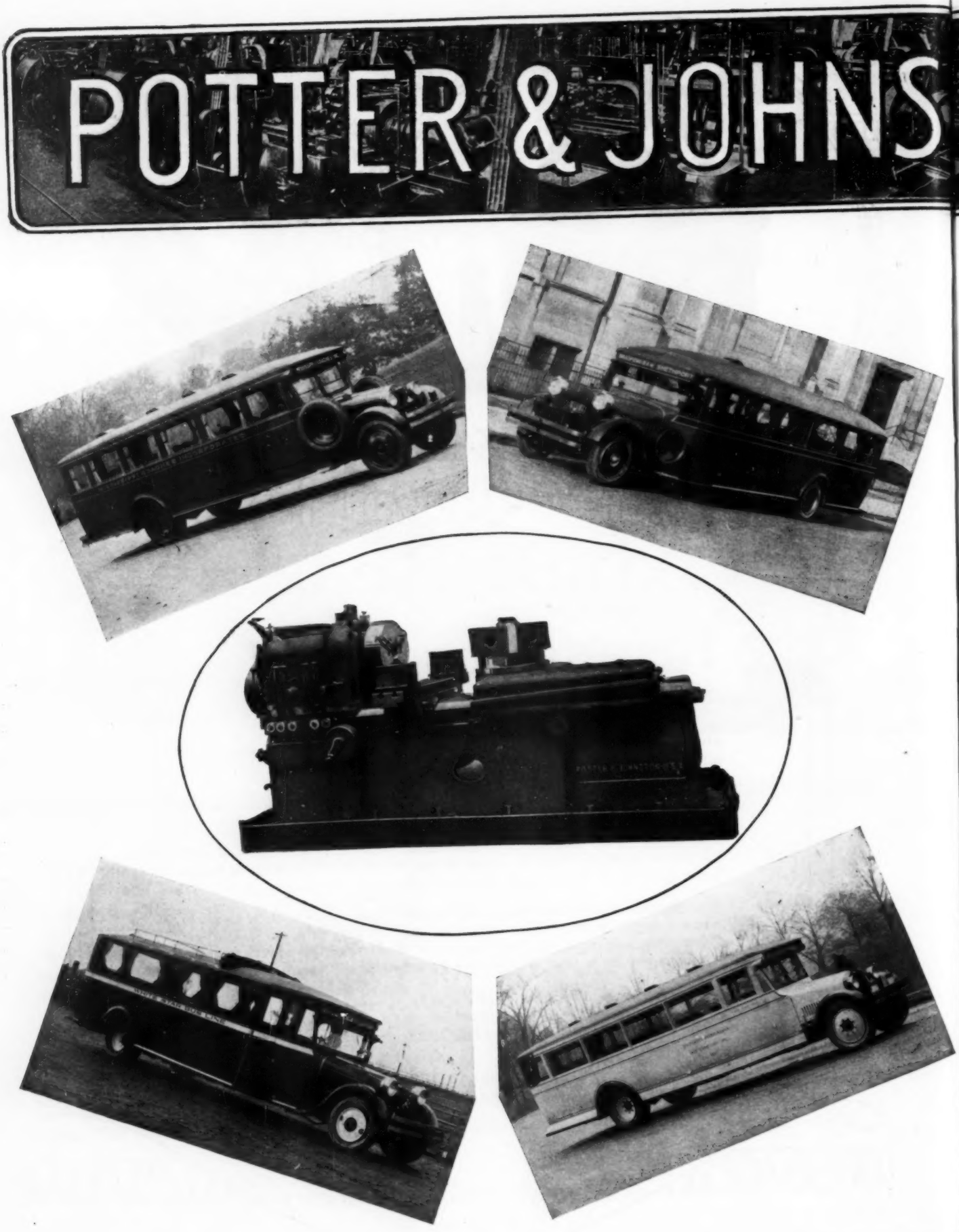
The use of New Departure Ball Bearings in both the centrifugal and electric motor, together with the use of grease as a lubricant, made this installation both more efficient and trouble proof.

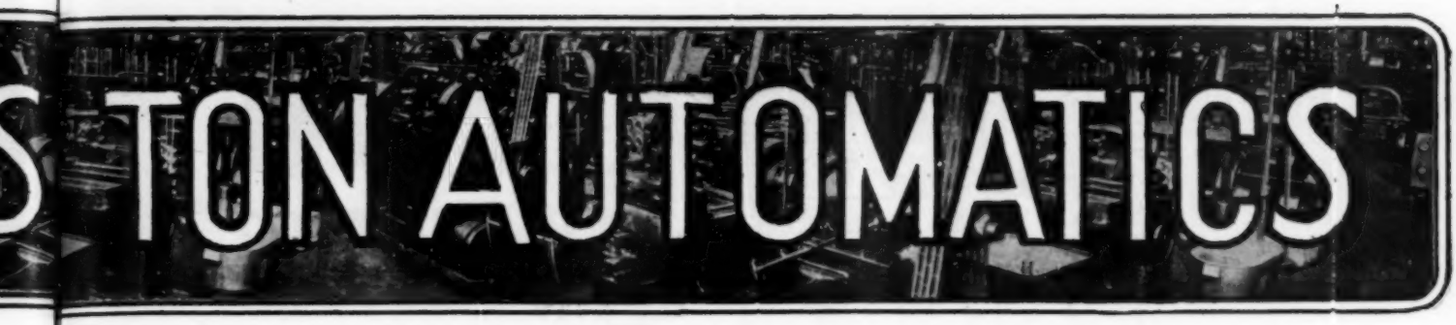
The electric motor is mounted to swing into a horizontal position to allow removal of the basket. This change of position, perfectly safe with New Departures, might (if sleeve bearings were used) allow oil to leak into the windings and cause short-circuits and burn-outs.

Engineers and designers are offered a copy of "Ball Bearing Application" for their reference library—a loose leaf book of bearing applications to which new sheets are added monthly by the New Departure Engineering Department.

THE NEW DEPARTURE MFG. CO.
Detroit *Bristol, Conn.* Chicago

407


POTTER & JOHNS



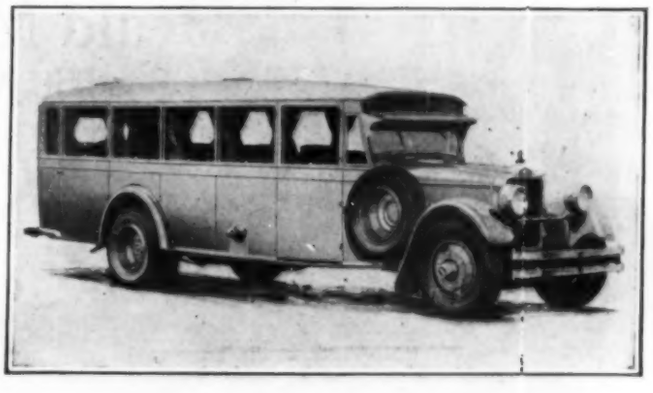
In Operation From Coast to Coast

Increased transportation facilities have been made possible and travel has been made easy, and with greater comfort by the use of Motor Busses.

The White Motor Company of Cleveland have developed a line of Busses, in appearance, comfort and for express service they are "De Luxe." To make all this possible the production engineers have a busy time figuring out the best possible methods for the production necessary to carry out their program.

The "Automatic Way" was decided upon and the Potter & Johnston Automatics chosen as economical machines for the manufacture of these duplicate parts. As the thousands of people ride in these busses little do they realize just what is going on inside of the plants for the convenience of travel.

Write in and we will tell you more about what we are doing along this line and also what we can do for you.



POTTER & JOHNSTON

Pawtucket **R.I., U.S.A.**

DOMESTIC OFFICES: New York Office: 270 Madison Ave., Frank H. Robinson, Manager. Detroit Office: The Potter & Johnston Agency Co., 535 Bates St. Chicago Office: 3057 Eastwood Ave., Leslie J. Orr, Manager. Pacific Cost Offices: Louis G. Henes, 1418 Santa Fe St., Los Angeles, California. Louis G. Henes, 75 Tremont Street, San Francisco, California.
CANADIAN REPRESENTATIVE: Arthur Jackson, 32 Glenholme Ave., Toronto, 10 Ont., Canada.

FOREIGN REPRESENTATIVES: L. J. Colomb, 68 Avenue de la Grande Armee, Paris, France, Representative for France, Belgium, Switzerland, Spain and Portugal. Charles Churchill & Co., Ltd., London, Birmingham, Manchester and Newcastle-on-Tyne, England and Glasgow, Scotland. Ercole Vaghi Corso Porta Nuova, 43 Milan, Italy. Rylander & Asplund, Stockholm, Sweden. Yamatake Company, No. 1 Yurakucho, Ichome, Kojimachiku, Tokyo, Japan.

Staging a Grand Guessing Contest

Mr. Heald recently came into the Advertising Department and said, "Down at the Convention, I was talking to Mr. Blank (one of the most progressive machine tool builders of today) and his message is worth broadcasting to all who do Internal Grinding in large or small amounts. Here is what Mr. Blank said:

'When I went down into my factory and began analyzing what our men on the Internal Grinders were doing, I found that they were STAGING A GRAND GUESSING CONTEST. They start in to rough out the hole and when they think it is nearly to size, they plug it, not only once but many times, why, they even have a plug made special under size about .001-in.

Today, it is a different story for with your SIZE-MATIC Internal, after setting up for the first piece, it then becomes a simple matter of chucking and throwing over the starting lever, every piece coming exactly to size with no time spent running A GUESSING CONTEST.

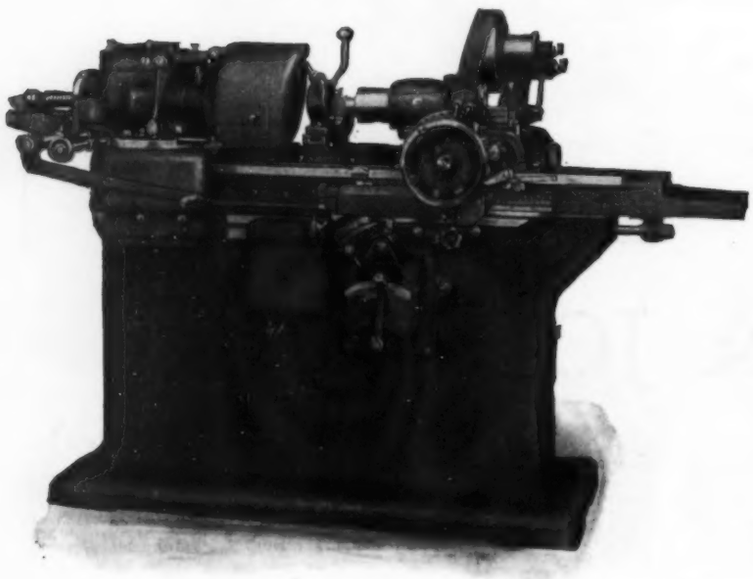
Of course, on small lots we use the standard machine but when we have 50 or 100 pieces, we are glad to set up for it and can run them off without worry.' "

Are you running a GUESSING CONTEST in YOUR shop? Go personally into your factory and watch the grinder hands. They don't guess because they like to but because they haven't the equipment that gives the results without guessing.

We have it! May we send you literature?

The Heald Machine Co.

35 New Bond St., Worcester, Mass.



1826 ONE HUNDRED HEALD YEARS OLD 1926

The Heald SIZE-MATIC Internal

No plugs *No gages*

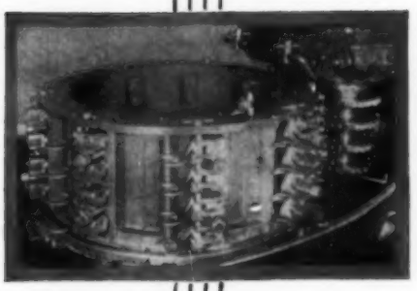
NEWTON

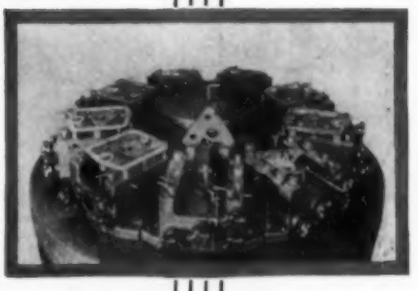
(REGISTERED TRADE MARK)

CONTINUOUS MILLERS

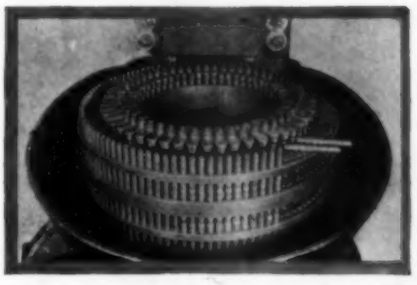
Ultra-Rapid Production

The automobile has no monoply on high-pressure, rapid production methods. There are hundreds of manufacturing plants who are learning to cut their costs by installing Newton Continuous Milling Machines fitted with Modern Cutters (made by our Modern Tool Works).



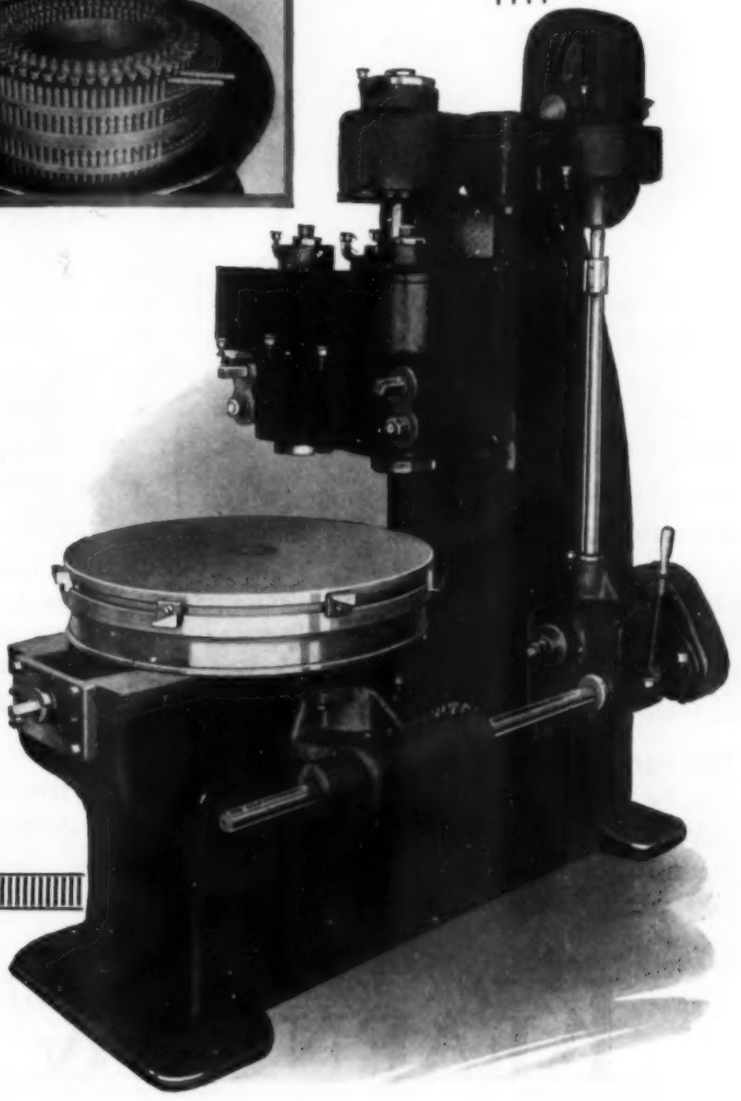


Here are shown just a few operations on which Newtons have helped to solve the manufacturing problem — problems precisely like those solved by us continually — and exactly like those being solved by us for the automobile industry.



Perhaps our engineering department can help you solve such a problem. Why not submit your specifications and let us show you how Newton Continuous Millers can help you.

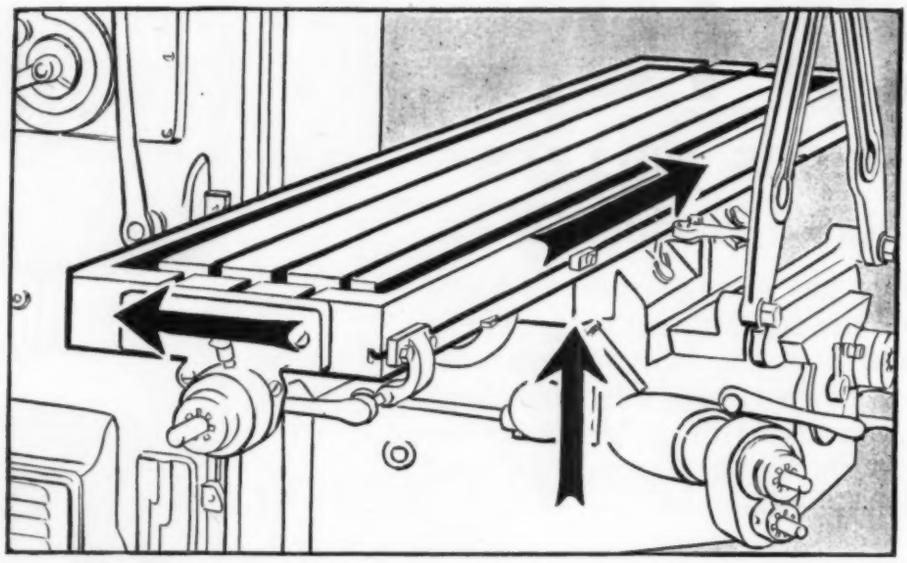
CONSOLIDATED MACHINE TOOL
CORPORATION OF AMERICA
ROCHESTER, N. Y.
BETTS-NEWTON-COLBURN
HILLES & JONES—MODERN



CONSOLIDATED MACHINE TOOLS

"Newtons are most efficient when fitted with Modern Cutters."

IF IT CAN BE MILLED — MILL IT FASTER!



Power Rapid Traverse in 3 Directions

on K & T's New No. 4 Milling Machine

In or Out
Up or Down
Left or Right

THE prevailing style in machine tool design calls for Power Rapid Traverse. You find it on the new planers—boring mills—lathes—in fact, it is now considered as a machine shop necessity.

Power Rapid Traverse has long been applied to milling machine tables. But now Kearney & Trecker have gone forward another step. On their big new No. 4 milling machine, Power Rapid Traverse is provided not only for the table—but for the saddle and knee as well.

The rates of travel are very fast. The table can be quick traversed left or right at the rate of 150″ per minute—in or out, at 70″ per minute—and up or down at the rate of 50″ per minute. All movements are conveniently controlled from the front of the machine. Power Rapid Traverse in all directions is a big factor in the ease with which the milling machine may be either set up or operated. Particularly is this true when raising the table carrying a heavy work piece.

Next to safety, the biggest production factor is ease of operation. Power Rapid Traverse in 3 directions means that the operator will get more work out of a Kearney & Trecker No. 4 Milling Machine—and with less physical effort on his part.

This big No. 4 Miller with its many productive features is fully described in a new illustrated bulletin. Have you a copy?

KEARNEY & TRECKER CORPORATION
Milwaukee Wisconsin

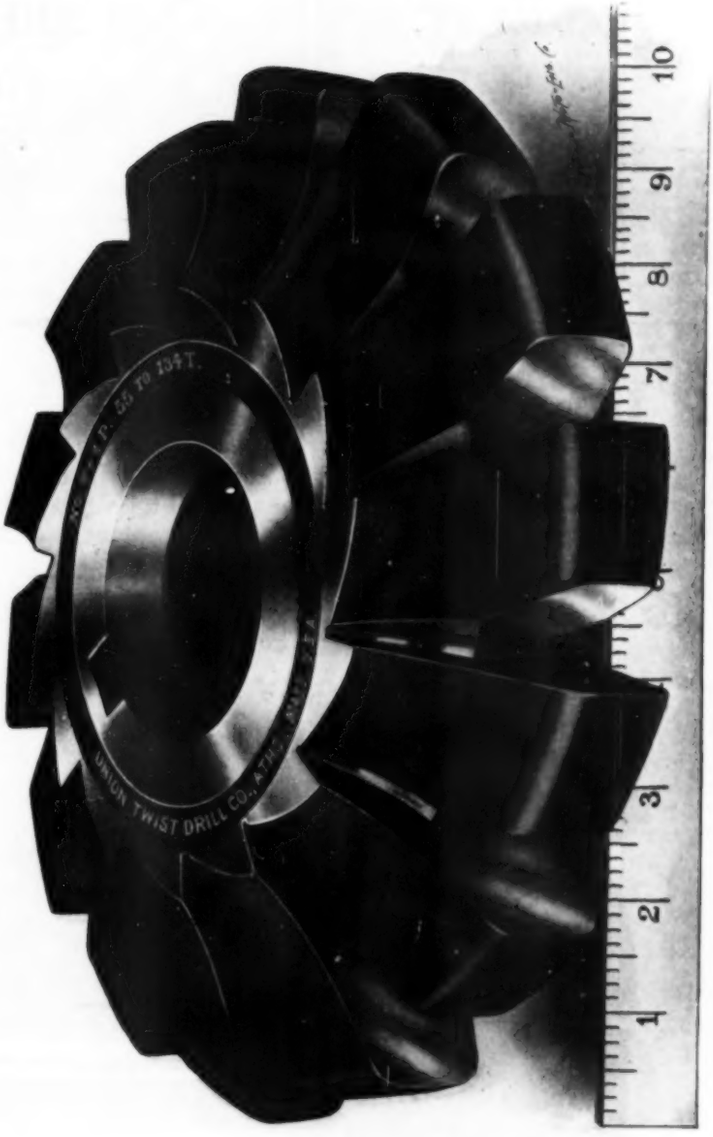
MILWAUKEE MILLING MACHINES

KEARNEY & TRECKER

Union Gear Cutters

Our Involute Gear Cutters are produced from ORIGINAL FORMS by use of special machinery under careful supervision.

From 1 to 48 Pitch, Carbon or High Speed Steel. We are prepared to Form Grind Gear Cutters.



Union Twist Drill Co., Athol, Mass.

Chicago Store—11 So. Clinton St. **New York Store—62 Reade St.**

Makers of All Kinds of Cutttrs, Twist Drills, Reamers, Taps, Dies, etc.

AGENTS THROUGHOUT THE WORLD

MONARCH LATHES

HELICAL GEARS, BALL BEARINGS
FAST SPEED AND FEED CONTROLS
MULTIPLE DISC CLUTCH

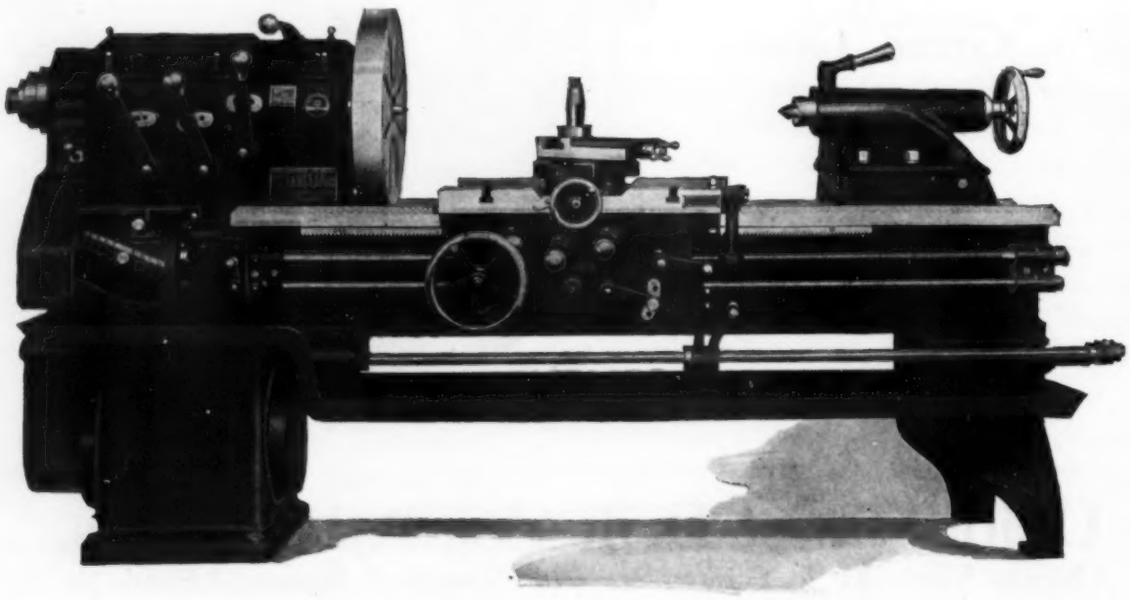
These are just a few of the many radical improvements in lathes largely pioneered by Monarch.

Take the Multiple Disc Driving Clutch for instance. In 1924 Monarch adopted this type of clutch which was a radical departure from the previous types of control clutches for machine tool use that have been so troublesome in the past.

Today, over two years later, we find a large number of manufacturers of high grade machine tools adopting the Multiple Disc Clutch.

Naturally the cost of the Multiple Disc Clutch is very much more than the former types of clutches. Monarch uses nothing but the finest materials. Price is a secondary consideration.

In modernizing your lathe equipment these many Monarch improvements will convince you that Monarch lathes will no doubt be modern for several years to come.



The Monarch Machine Tool Co., Sidney, Ohio

"Prolong Prosperity with Modern Machine Tools."

2400 *files to choose from*

Fly Rods and Files

TRADE MARK — ONLY THE BEST ARE GOOD ENOUGH — FILES — TOOLS

WHEN your luck is good, and the fish grab the bait, don't you thrill at the feel of the rod in your hand—its balanced weight, its comfortable grip and the willowy strength that you can count on when a big 'un puts up a stiff fight?

We can't say you'll be thrilled by the feel of an ***American Swiss*** File in your hand, but you will like the heft of it. You'll appreciate the way its weight is balanced to relieve the strain of filing. And when you tackle a particularly tough job, you'll be glad of the reserve strength that's been hardened into its keen, straight blade.

American Swiss Files are sharp and stay sharp long after the average file has found its way to the scrap heap. That's why they are "cheaper in price per chip." That slogan was originated by a veteran mechanic who uses ***American Swiss*** Files exclusively. And thousands like him, from coast to coast have found this statement to be no idle boast.

American Swiss
File & Tool Company
410 Trumbull Street
Elizabeth, New Jersey

American Swiss Distributors

Baltimore, Md.
The L. A. Benson Co.
Boston, Mass.
Chandler & Farquhar Co.
Bridgeport, Conn.
Hunter & Havens
Buffalo, N. Y.
Louis F. Seltenreich
Chicago, Ill.
Machinists Supply Co.
Cincinnati, Ohio
E. K. Morris & Co.
Cleveland, Ohio
White Tool & Supply Co.
Dayton, Ohio
M. D. Larkin Co.
Detroit, Mich.
Boyer-Campbell Co.
Detroit, Mich.
Chas. A. Strelinger Co.
Elizabeth, N. J.
Hand Hardware Co.
Hartford, Conn.
Tracy, Robinson & Williams Co.
Indianapolis, Ind.
Vonnegut Hardware Co.
Long Island City, L. I., N. Y.
Long Island Hardware Co.
Los Angeles, Cal.
Ducommun Hardware Co.
Milwaukee, Wis.
Phillip Gross Hdwe. & Sup. Co.
Minneapolis, Minn.
F. E. Satterlee Company
Newark, N. J.
Banister & Pollard Company
Newark, N. J.
Ludlow & Squier
Newark, N. J.
Seither & Ellis
Newark, N. J.
Squier, Schilling & Skiff
New Haven, Conn.
C. S. Mersick & Co.
New York City
Anchor Tool & Supply Co.
New York City
J. & C. Ernst
Passaic, N. J.
New Jersey Eng. & Supply Co.
Pittsburgh, Pa.
Joseph Woodwell Co.
Philadelphia, Pa.
Aetna Machinery Co.
Providence, R. I.
Z. Berberian Co.
Rochester, N. Y.
Sidney B. Roby Co.
St. Louis, Mo.
St. Louis Mach. & Supply Co.
San Francisco, Cal.
C. W. Marwedel
Springfield, Mass.
W. J. Foss Co.
Syracuse, N. Y.
Syracuse Supply Co.
Toledo, Ohio
Kirkby Machy. & Supply Co.
Toronto, Ont., Canada
The Masco Co., Ltd.
Troy, N. Y.
Fred K. Blanchard, Inc.
Waterbury, Conn.
Hamilton Hdwe. Corp.
Worcester, Mass.
Duncan & Goodell Co.

American Swiss File & Tool Co.,
410 Trumbull St., Elizabeth, N. J.

Please send me my *free copy* of your new booklet.

Firm .....

Name .....

Address .....AM 21

The ink is hardly dry

write for one of these new books
just off the press

It will give you a new conception of planers. Next to seeing a Time Saver Planer in operation, a glance through the book will convince you that this planer represents the highest development to date in planers.

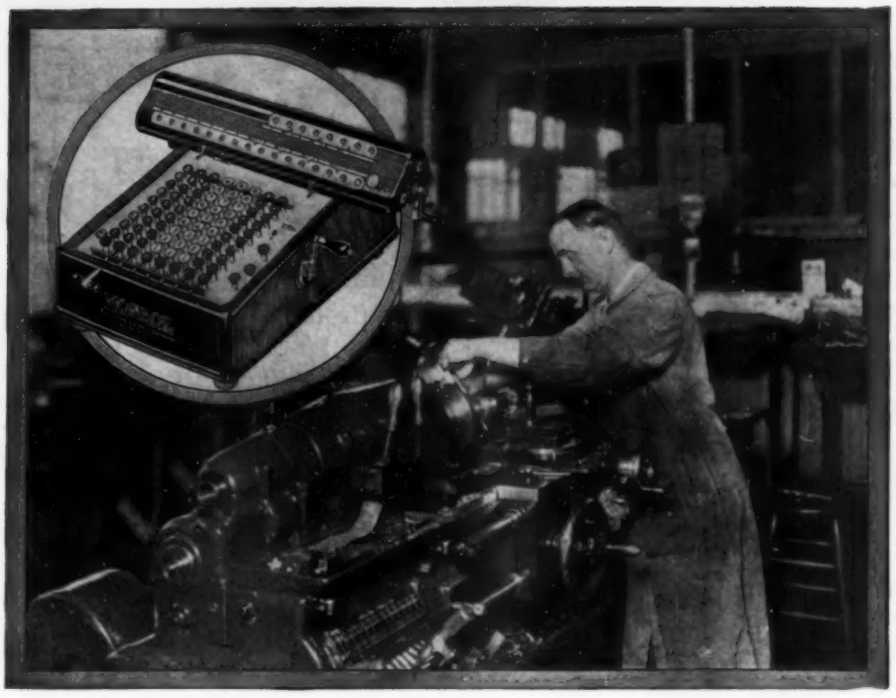
New features are shown; features that have not yet appeared on competitive planers.

Whether you are in immediate need of a planer or not, write for this book. If you *do* need one, then let us send a man to go over with you the details of this remarkable planer.

The Niles Tool Works Company

Division Niles-Bement-Pond Company

Hamilton, Ohio



Jim makes it "*talk*"

JIM JOLLIE—and that is his real name—works for the Monroe Calculating Machine Co. Jim is a star lathe hand with a great reputation as a fine workman.

Sometime ago, they installed a 13-inch Pratt & Whitney lathe. It was a case of love at first sight. The working beauty of this lathe aroused such enthusiasm in Jim, that in answer to a question, he said: *"I can almost make this lathe talk"*

The Pratt & Whitney Model B lathe is a marvel of smooth, efficient operation. It takes big cuts without a quiver and works to the finest dimensions without doubt or question.

We are proud to have this machine in the Monroe plant—proud to have it operated by a man like Jim Jollie. And when you buy a Monroe machine which gives you perfect satisfaction, we are glad of our small share in the making of it.

Let the Model B "talk" for you. Let it tell you of work well done, quickly done *and at the lowest possible cost.*

Write for the complete story of
MODEL B LATHES

PRATT & WHITNEY CO., *Hartford, Connecticut*
Division NILES-BEMENT COMPANY

PRATT & WHITNEY

Wring Profits From Production Costs

Quick work? Sure! Maximiller design eliminates lost motion.

Take this cast steel quadrant: floor to floor production in milling the radius slot 1-3/16 in. wide, 2 in. deep over a 2¼ in. length with a two lip type cutter was half an hour. *Simple, quick, low-cost results indeed.*

Operation of the Maximiller is centralized at the front—*operation ease.*

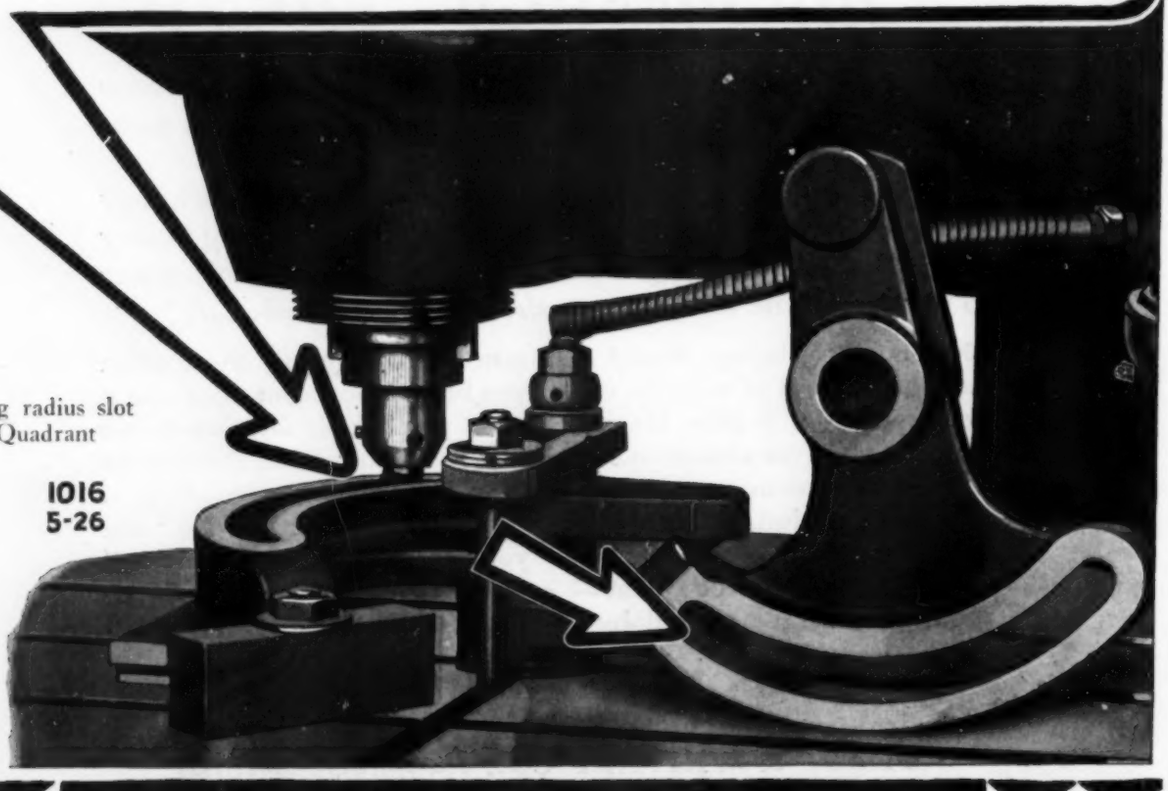
Exceptional worm-drive, feed mechanism construction and wide feed range —*adaptability for tool room or production.*

Using the Maximiller with the Kempsmith attachments your production costs will result in production profits.

Comparative cost figures from our engineering staff will show you, quickly, how to squeeze the waste time out of your production.

Put your difficulties up to us.

THE KEMPSMITH MANUFACTURING CO.
Milwaukee, Wis.

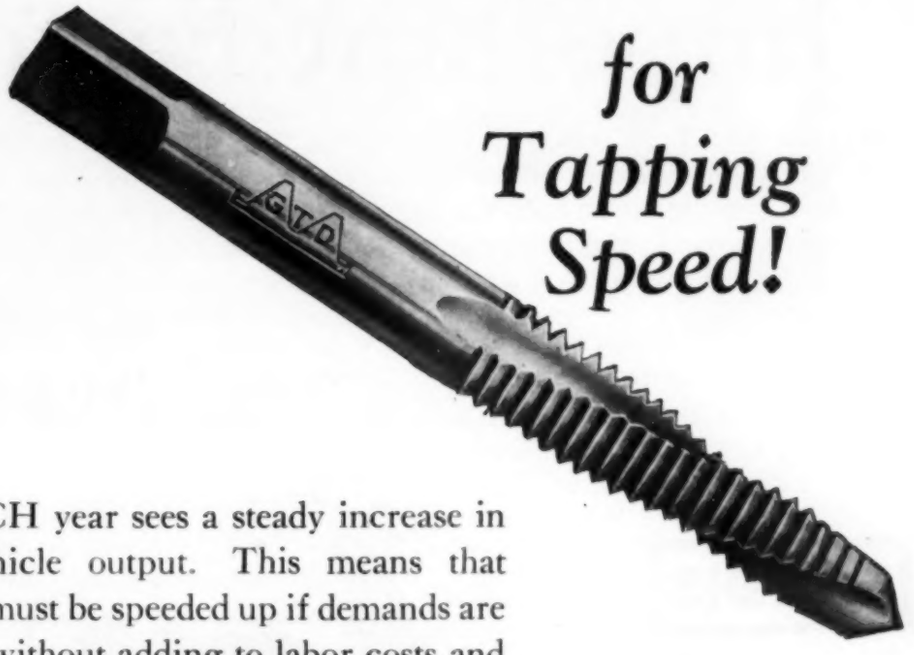


Milling radius slot in Quadrant

1016
5-26

KEMPSMITH

Come to Headquarters!



for Tapping Speed!

EACH year sees a steady increase in motor vehicle output. This means that processes must be speeded up if demands are to be met without adding to labor costs and overhead.

The GTD High Speed Ground Thread Gun Tap has solved the threading problem. Its clean, shearing cut permits of speeds that equal drilling speeds. Its design insures against clogging as all chips are "shot" ahead of the advancing tap.

Obsolete methods and obsolete tools must go the way of all "wasters," and our Threading Engineers will give you facts and figures as proof that you should start replacements now.

GTD

Ground Thread High Speed Gun Taps

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

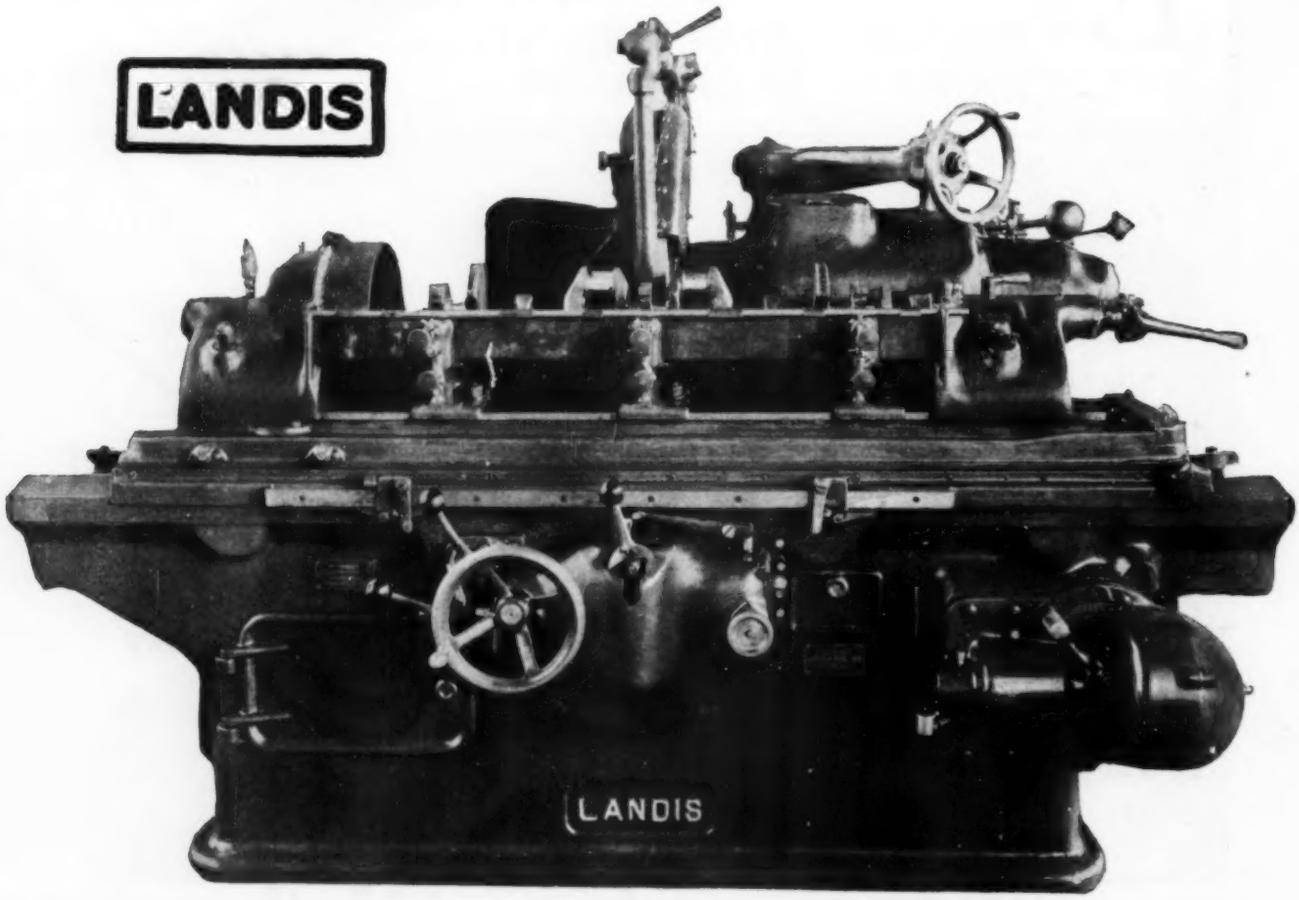
Detroit Store: 224-226 West Congress St. *Chicago Store: 13 So. Clinton St.*
New York Store: 15 Warren St.
Canadian Plant: Greenfield Tap & Die Corporation of Canada, Limited, Galt, Ont.
London Office: Greenfield Tap & Die Corp., 139 Queen Victoria St., London, E. C. 4

GTD Screw Plates, Taps, Dies, Reamers, Gages, Pipe Tools, Twist Drills, Screw Slotting Cutters

The Final Cost is the Important Factor

Although the first cost of a machine may appear exorbitant, judgment should not be conclusive until the final costs have been determined. A grinder on which the initial cost appears high has built into it all elements which make for continued accuracy and long life. The productive capacity is also of vital importance.

The LANDIS Hydraulic Grinders, in every installation have shown marked capacity for economy in operation and increase in production. In some cases this increase in production is as much as 50%, with actual operating costs reduced accordingly.

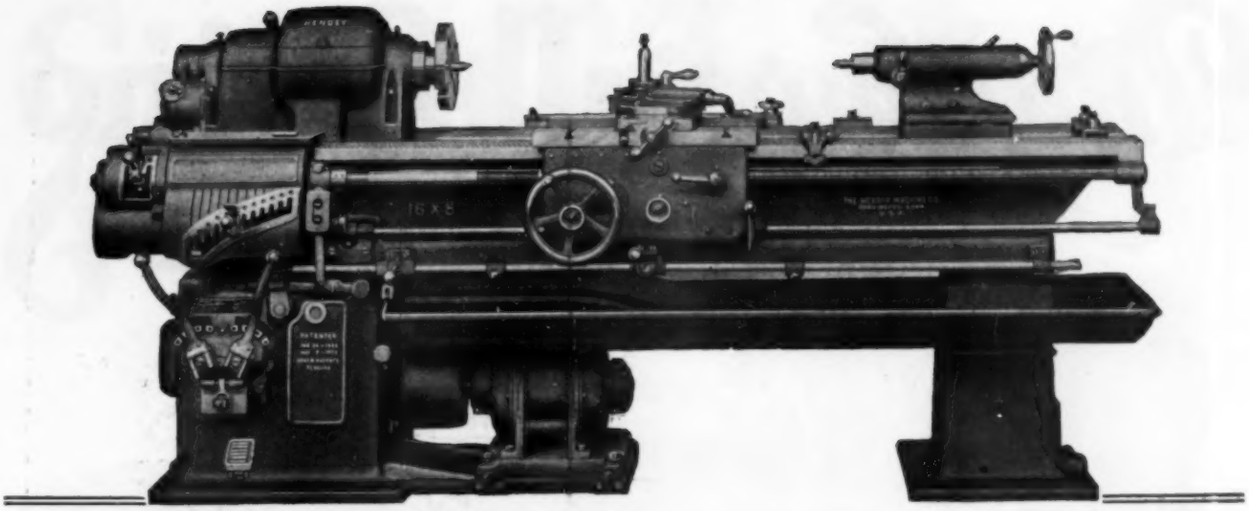


LANDIS TOOL COMPANY, Waynesboro, Pa.

New York Office, 30 Church Street

Chicago Office, 618 W. Washington Blvd. Detroit Office, 5928 Second Blvd.

Domestic Agents: Hallidie Machinery Co., Seattle; Smith-Booth-Usher Co., San Francisco and Los Angeles; Peden Iron & Steel Co., Houston; Fulton Supply Co., Atlanta; F. C. Richmond Machinery Co., Salt Lake City; Moore Handley Hardware Co., Birmingham. **Canadian Agents:** F. F. Barber Machinery Co., Toronto; Williams & Wilson, Ltd., Montreal. **Foreign Agents:** R. S. Stokvis & Zonen, Rotterdam; R. S. Stokvis & Fils, Paris and Brussels; Anderson, Meyer & Co., Ltd., Shanghai; Andrews & George Company, Ltd., Tokyo; Benson Brothers, Sydney and Melbourne; Burton Griffiths & Co., Ltd., London; Wilh. Sonesson & Co., Malmo and Copenhagen.



As good on manufacturing as it is on Toolroom work—

The very same reasons that have made Hendey Lathes the preferred choice for exacting toolroom work, are the very same reasons that make them the best buy on manufacturing work.

Long maintained accuracy, absolute dependability and an operating ease that encourages men to produce better work and more of it by the sheer handiness of controls.

And the addition of individual motor drive in these E. B. M. (Enclosed Belt Motor Drive) Models has not complicated this easy handling in any way.

Because the electrical controls have been perfectly coordinated with the mechanical controls. The operator merely shifts the lever as he has always done—the electrical current is momentarily broken, the gears shifted and the current turned on again—by the same easy shifting of the lever. *Simple, safe and sure!*

Retains the famous Hendey Quick-Change mechanism—thirty-six different feeds for work or threads instantly available by merely shifting a lever—*the simplest foolproof mounting ever devised.*

Nine spindle speeds, doubled to eighteen thru back gears, give the most efficient speed for every kind of work.

The enclosed Belt Motor Drive combines the smooth flexible vibrationless belt drive with all of the multiple advantages of constant speed motor application.

Whether you require a flexible lathe for the toolroom or steady high production unit for general manufacturing, you will wisely examine this new E.B.M. Hendey.

A postal brings the literature!

MILLING MACHINES **HENDEY** LATHES SHAPERS

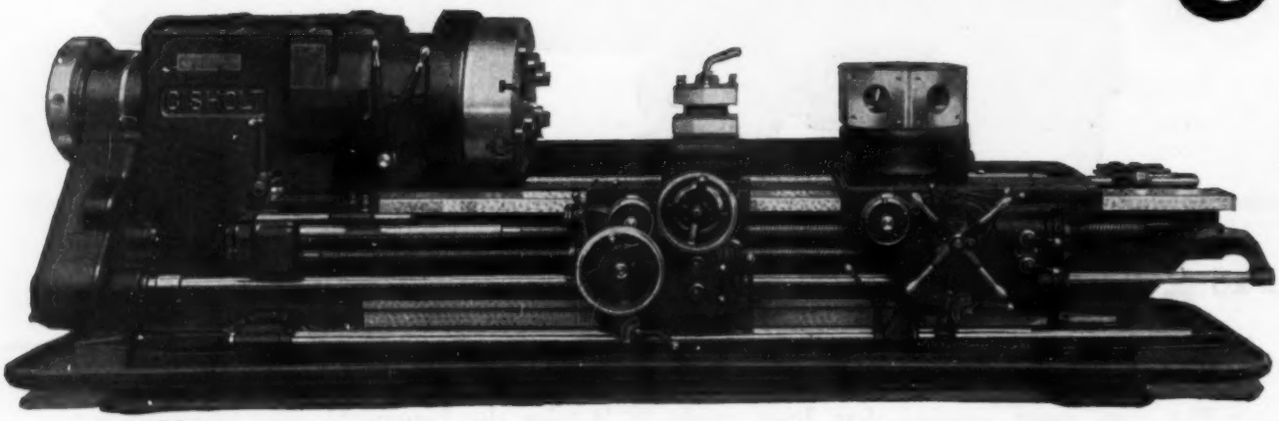
MACHINE CO., TORRINGTON, CONN.

Branch Offices: **Singer Bldg., New York City** **565 Washington Blvd., Chicago, Ill.** **Commerce Bldg., Rochester, N. Y.**

DOMESTIC AGENTS: Barney Machy. Co., Pittsburgh; Lloyd & Arms, Philadelphia; W. M. Pattison Supply Co., Cleveland and Detroit; E. D. Morton & Co., Louisville; F. E. Satterlee Co., Minneapolis; Louis G. Henes, San Francisco and Los Angeles; Portland Machy. Co., Portland; Perine Machy. Co., Seattle; Williams & Wilson Ltd., Montreal; A. R. Williams Machy. Co., Toronto.

FOREIGN AGENTS: Charles Churchill & Co., Ltd., Birmingham; J. C. H. Vanduyl & Zoon, Rotterdam; Henry Coe & Cierici, Milan; Aktiebolaget Oscar Lindbom, Stockholm; Swiss Machy. Import Ltd., Zurich; C. E. Carpenter & Co., Paris; Park & Lacy Co., Sydney; Mitsui & Co., Ltd., Tokyo; Amtorg Trading Corp., U. S. Soviet Republic; Bohm & Bormann, Berlin; D. Drury & Co., Johannesburg.

The New Full Swing Powerful



5336

All Geared Head

Single Pulley Drive

Independent Lead Screws Feeds Rapid Traverse

All Transmission Shafts on Ball Bearings

The new full swing Gisholt Turret Lathes are designed to give your production the benefit of every COST REDUCING device together with a maximum CONVENIENCE OF CONTROL and LOW COST OF MAINTENANCE.

Built in sizes to cover a wide range of output—there is a size for your work.

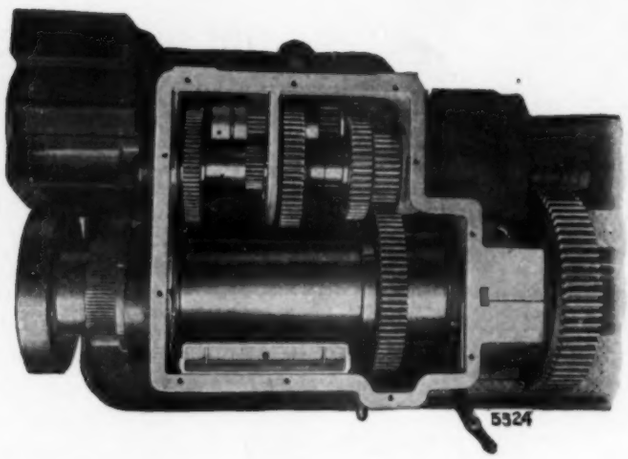
	3L	4L
Swing over bed	**21"**	**28"**
Spindle bore	**4-⅝"**	**9-¼" - 10-½" or 12-¼"**

GISHOLT MACH

Madison,

Gisholt Turret Lathe

Productive



The bed, headstock and bearing housing are cast in one piece, the latter being bored taper for adjustment of bearings. The headstock walls extend above the top of the bearing housing forming an oil tight reservoir for the *splash oil system* and tying the whole unit rigidly together without joints or bolts.

The single pulley drive has an outboard bearing and is fully encased for safety. A double Multiple Disc Clutch with steel driving plate and bronze driven plate running in oil transmit the power to the gearing and a multiple disc brake stops the inertia of the spindle when the drive clutch is thrown into neutral.

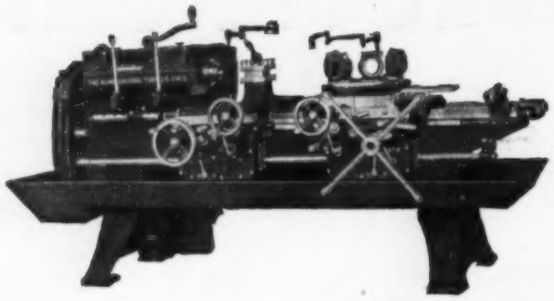
All gears are of *alloy steel heat treated* and run in oil. The large face plate gear which is keyed to the flange on the main spindle provides a powerful leverage for the heavier work and prevents torsional strains through the spindle. The spindle is of forged steel .60 carbon.

All power transmission shafts in the headstock (as well as in the entire machine) are mounted on large ball bearings practically eliminating friction and reducing lubrication requirements to a small fraction of that required for plain bearings. The short distances between bearings is one of the outstanding features of the design throughout. Ball thrust bearings are provided for spindle, feed nuts, etc.

INE COMPANY

Wisconsin, U. S. A.

The No. 2 Cincinnati Acme



a lathe which is truly universal—

As many as six operations obtained at one set-up!

This lathe can save you considerable time usually wasted in setting up tools for different operations, and the product is finished with the utmost precision. We will gladly give you an estimate from your blueprints of the time you can save by adapting the Cincinnati-Acme No. 2 to your needs.

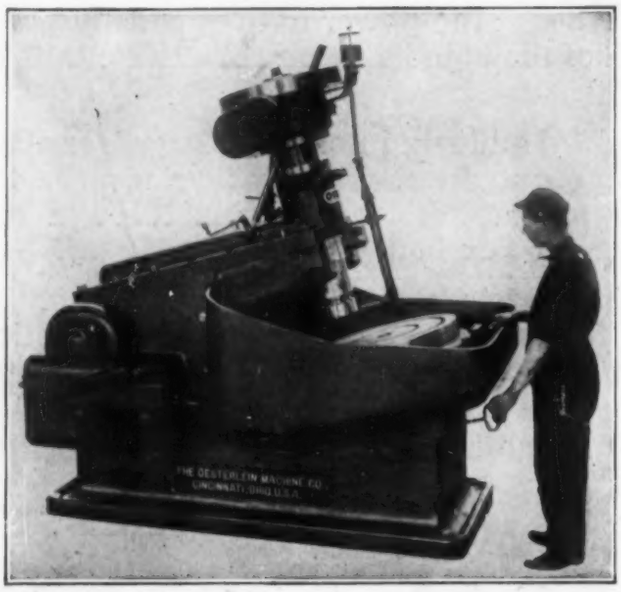
Since its introduction to machinists, The Cincinnati-Acme universal turret lathe has steadily lowered production costs and raised lathe standards. Users are its most enthusiastic boosters. Send a print of your work. There is no obligation entailed.

CINCINNATI
MAKES MORE MACHINE TOOLS IN LARGER VARIETY THAN ANY OTHER TOOL BUILDER
SO SEE AND SIZE UP LOCATE MACHINE TOOL COME TO
CINCINNATI

The Acme Machine Tool Co., Cincinnati, Ohio

Flat Turret Lathes—Screw Machines—Turret Lathes

A Station Miller with all the time-out factors eliminated



OHIO

TILTED ROTARY

Known as the Milling Machine second to none, actually spending 98% of the time cutting. A reciprocating spindle feeds the cutters into the work and withdraws, until the table indexes to the next position.

Excepting the six to nine seconds required to index the table and bring the cutters in contact with the material, there is absolutely no lost time.

Here is a high speed producer that is also efficient on comparatively small lots. Switching from one job to another is a simple matter of replacing one set of four fixtures for another and changing the cutter feed in cam.

The Ohio Tilted Miller cuts out waste motions, the direct objective of economical methods.

We are sure that our illustrated booklet clearly explains this efficient producer. Write for a copy.

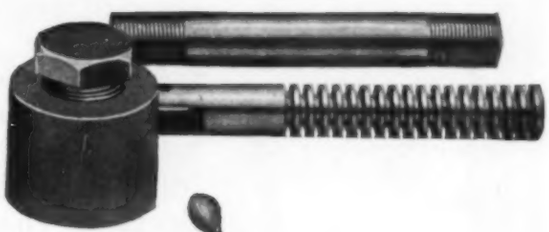
THE OESTERLEIN MACHINE CO., Cincinnati, Ohio

Mill Threads the Hanson-Whitney way and increase output ten-fold

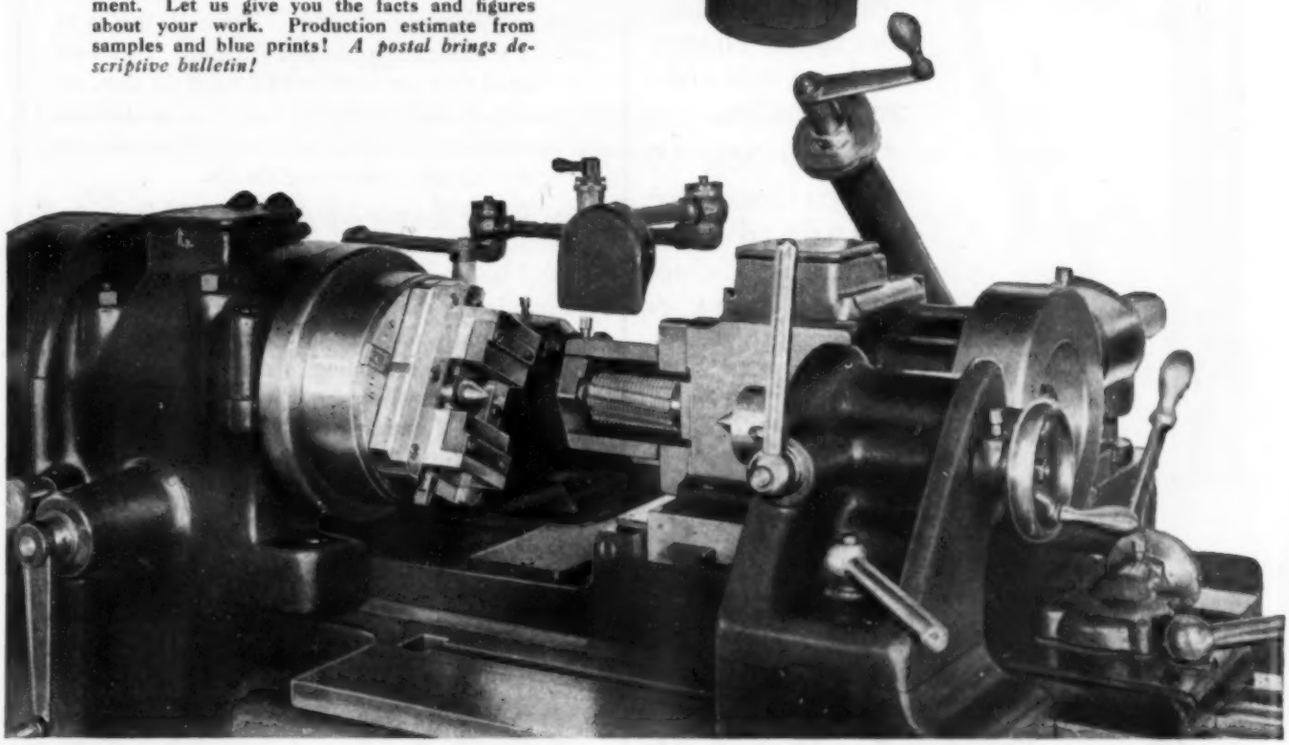
High production, virtually between *ten and twenty times the output* over that obtained with a single point tool, is not the only advantage of Milling Threads the HANSON-WHITNEY way.

Exceptional precision and smooth finish is assured by a high speed, "finished after hardening" hob, that completes the job in one revolution of the work. For instance, under the ordinary methods, a screw with 20 threads per inch has to make 20 revolutions to complete one inch of thread, whereas by the Hanson-Whitney Hob Milling method, the Thread Hob mills a perfect thread, complete, *in one revolution of the work.*

Full Semi-Automatic operation has a two-fold advantage. Because the hob is brought to the work, *automatically* and *automatically* returned, an apprentice boy can insert and take out the work. Hence, low labor cost without danger of spoilage is a big aid in cutting the unit cost to the bone.



Low labor cost, wide range and perfect work make this machine a mighty profitable investment. Let us give you the facts and figures about your work. Production estimate from samples and blue prints! *A postal brings descriptive bulletin!*



	REPRESENTATIVES	
New York, N. Y. . L. C. Biglow & Co.	Pittsburgh, Pa. . William K. Stamets	Dayton, Ohio. . . Seifreat-Elstad Co.
Syracuse, N. Y. . . George McPherson	Cleveland, Ohio. William K. Stamets	Detroit, Mich. . . . . A. G. Brice
Boston, Mass. . . . . George C. Stell	Cincinnati, Ohio. . Seifreat-Elstad Co.	San Francisco, Cal. . A. H. Coates Co.
Philadelphia, Pa. . . . D. J. Normoyle		Chicago, Ill. . . . . E. H. Huntington

The Hanson-Whitney Machine Company

HARTFORD, CONN., U. S. A.

BUTTERFIELD

TAPER AND BURRING REAMERS

—give unexcelled service under all conditions.

Expertly fashioned of toughest steel, they are specially designed to cut smoothly, resisting the usual tendency to chatter and cut out-of-round holes.

Catalog No. 19 describes the standard sizes and designs. Specials to your specifications.

BUTTERFIELD THE BETTER TOOLS

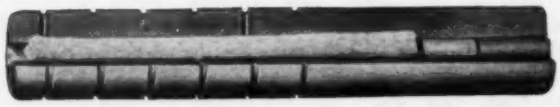
BUTTERFIELD & CO.
DIVISION
Union Twist Drill Co.

Derby Line, Vt., U. S. A.
Rock Island, Quebec, Canada.

Stores: New York, 63 Reade St. Chicago, 11 So. Clinton St. Detroit, 406 E. Woodbridge St. Toronto, 67 Adelaide St., West. Montreal, 131 St. Paul St., West.

5 minutes instead of one hour

. . . a far reaching economy for press room and tool room and for lower stamping costs



Danly Removable Leader Pin in Section. This shows taper locking plug, lubricating wick, oil channels and grooves. Insertion and removal from die shoe is a simple matter that can be performed in any shop easily, quickly, indefinitely.

One of the world's largest electrical manufacturers has reduced the time for grinding its dies from 1 hour to 5 minutes by using **Danly Removable Leader Pins.** You, too, can cut your grinding time and costs enormously by using **Danly Removable Leader Pins.**

Danly Removable Leader Pins enable dies to be ground without removal from the shoe. They save the loss of time for removing die from the shoe, remounting it and getting it back into production. They eliminate all sources of error and mistake due to removing and remounting the die.

The **Danly Removable Leader Pin** is revolutionizing tool-room procedure. It has eliminated one of the most troublesome problems of the tool-room. It has changed the grinding of dies from a difficult, costly problem to a simple matter. The time saved on one grinding by removing pins instead of removing die will more than pay for the **Danly Removable Leader Pins.**

Investigate this far-reaching improvement. Find out how it will affect your tool and press rooms. **Danly Removable Leader Pins** are available from stock in sizes from ½ in. dia. x 4 in. long up to 3 in. dia. x 14 in. long—111 sizes.

Write or phone nearest warehouse for the new 34-page treatise and catalogue.

Danly Machine Specialties, Inc.
4909 Lincoln Ave., Chicago

Detroit, Mich.
1537 Temple Ave.

Long Island City, N. Y.
35 Wilbur Ave.

Use **DANLY** DANLY STANDARD *Die Sets*

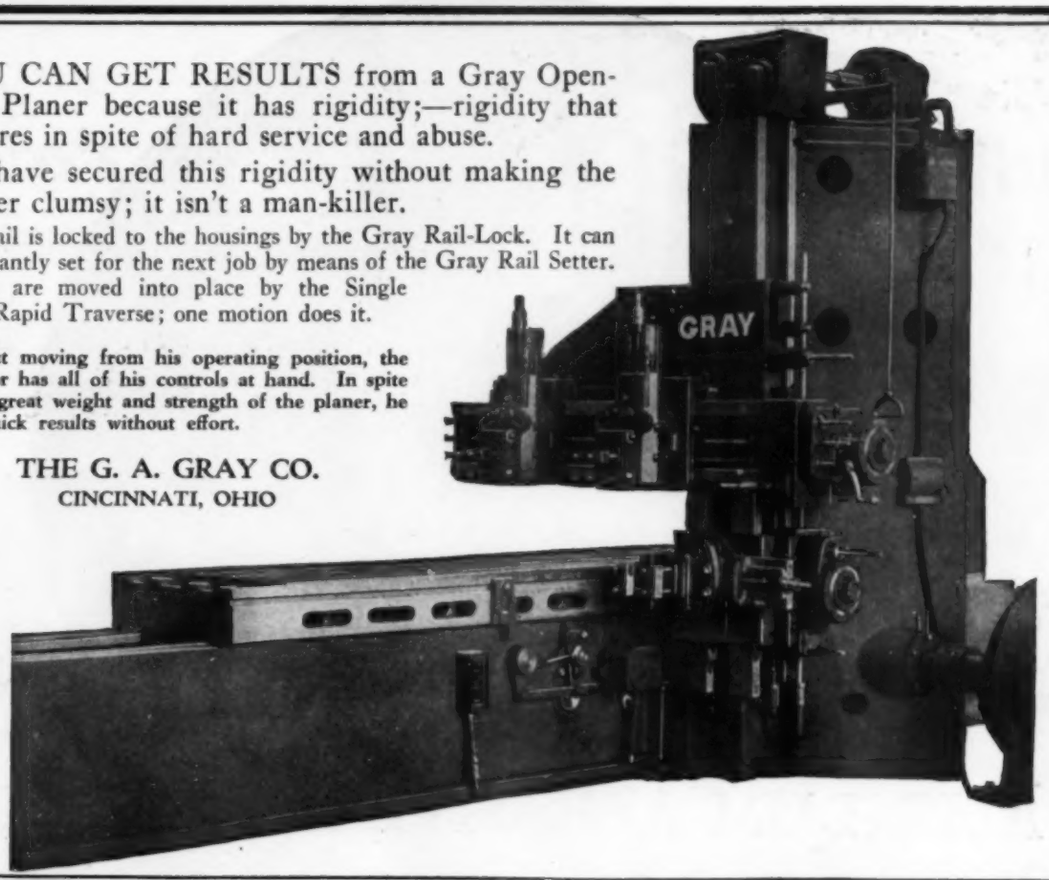
YOU CAN GET RESULTS from a Gray Open-side Planer because it has rigidity;—rigidity that endures in spite of hard service and abuse.

We have secured this rigidity without making the Planer clumsy; it isn't a man-killer.

The rail is locked to the housings by the Gray Rail-Lock. It can be instantly set for the next job by means of the Gray Rail Setter. Heads are moved into place by the Single Shift Rapid Traverse; one motion does it.

Without moving from his operating position, the operator has all of his controls at hand. In spite of the great weight and strength of the planer, he gets quick results without effort.

THE G. A. GRAY CO.
CINCINNATI, OHIO



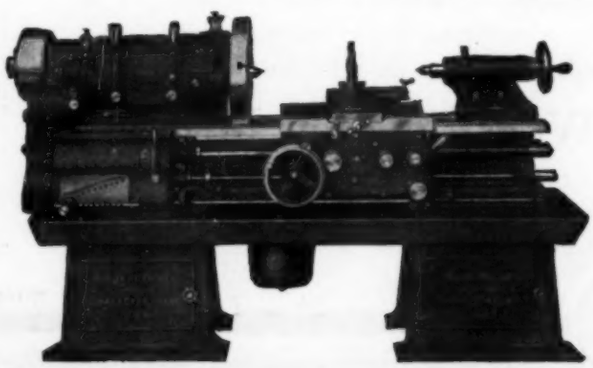
A Taper Attachment—As Good as the Lathe

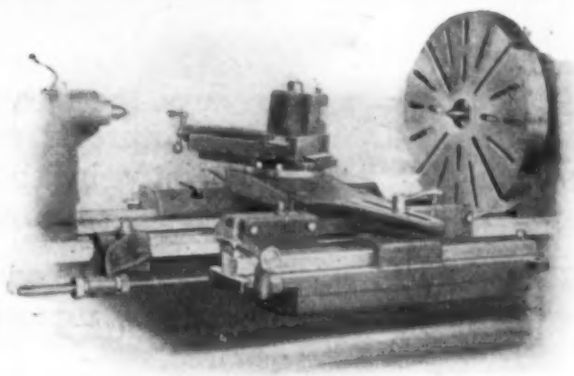
REED-PRENTICE MACHINE TOOLS

PRODUCTS
Lathes
Radial Drills
Becker Millers
Whitcomb Planers
Production Cutters
Special Machinery

The Reed-Prentice Taper Attachment delivers the action direct to the bottom blocks by an extension clamped to the taper bar shoe.

Easily attached, sturdily and accurately constructed, it insures taper turning as accurate and efficient and economical as the other operations performed on the high powered Reed-Prentice Geared Head Lathes.





A convenient Taper Attachment

Special equipment that gives complete efficiency adds to the value of all Reed-Prentice Production Machines. Tell us what you need—we'll show you how to increase profits on practically every class of work.

Why hamper your skilled men with obsolete equipment?

REED-PRENTICE COMPANY
MACHINE TOOLS
WORCESTER MASS. U.S.A.

Branch Offices:

New York, N. Y.
149 Broadway—1810 Singer Bldg.

Detroit, Mich.
345 General Motors Bldg.

Representatives throughout the World

ALUNDUM ABRASIVE for POLISHING

Uniform in grading and quality it makes possible more and better production

Because the electric furnace process of manufacture is under absolute control, uniformity in the quality of Alundum abrasive is certain.

Because of the care used in all screening operations, uniformity in grain sized is assured.

Thus it is that Alundum abrasive for polishing is the recognized standard for dependability and economy.

NORTON COMPANY, WORCESTER, MASS.

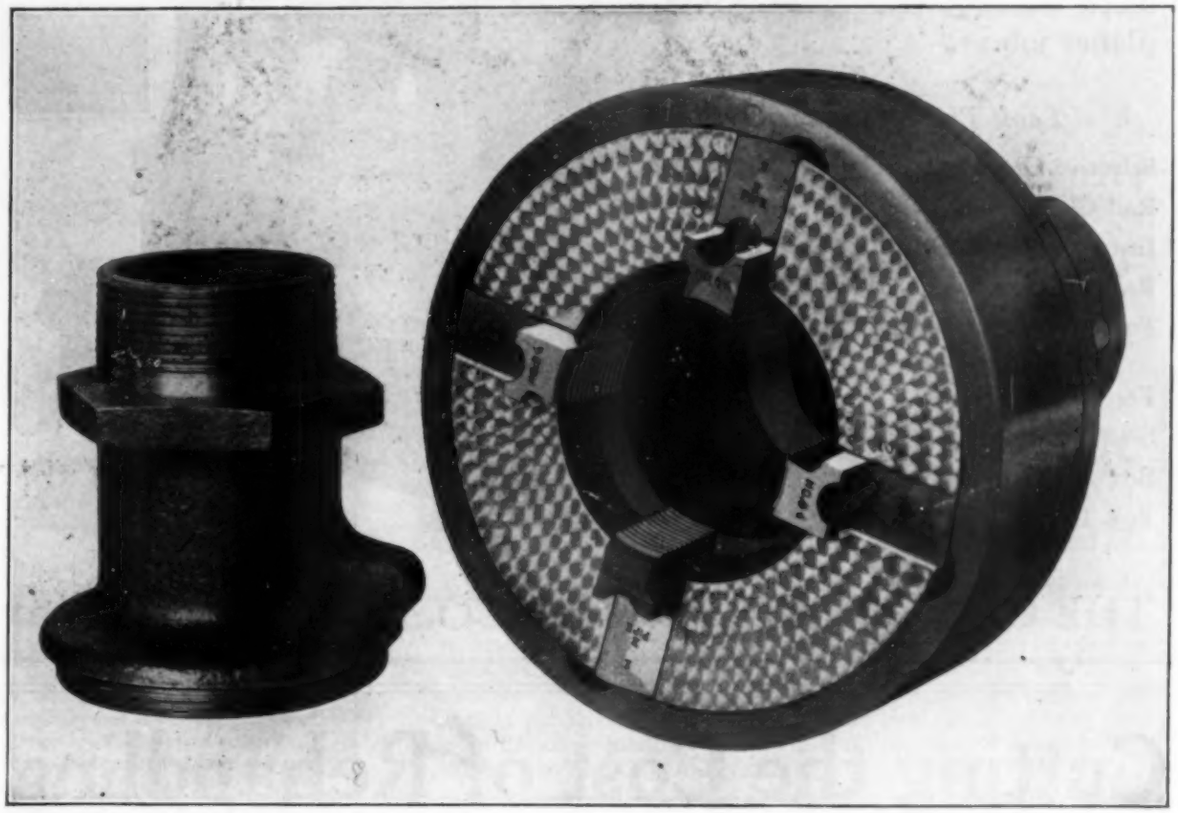
New York Chicago Detroit Philadelphia Pittsburgh

Norton Company of Canada, Limited Hamilton, Ontario

W-108

Forgings, Castings, or Bar Stock

There's a NAMCO Die for the Job!



Tho you may know that many people are using (and obtaining wonderful results from) NAMCO Hardened and Ground Dies on the smaller threaded parts made from bar stock, do you know that other customers are obtaining just as fine results from these tools on forgings and castings.

That brass casting shown here was threaded with a NAMCO Revolving Die on a Gridley Multiple Spindle Chucking Machine (also made by The National Acme Company).

But whether you require a revolving die or a hand die, NAMCO has a simple compact tool—cutting size ranges from $\frac{1}{8}$ in. to $4\frac{1}{2}$ in. —equipped with uniformly accurate chasers that will save you time and grief on your threading.

Let us prove it to you. Send B/P or Samples of your work.

The National Acme Company

Cleveland, Ohio

New York Detroit Chicago

We also make Hand Dies for stationary spindles and a complete range of Stationary and Revolving Collapsing Taps. Details sent on request or definite quotations to B/P or Sample.

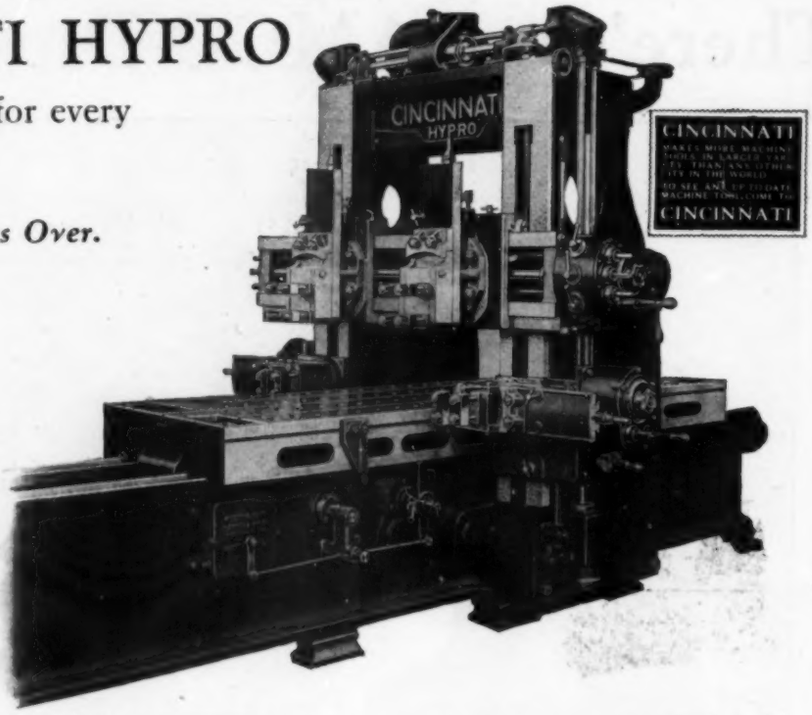
SELECT THE CORRECT TOOLS

CINCINNATI HYPRO

meets the requirements for every planer job.

Look These Features Over.

Selective Dial Feed.
Rail Clamping Device.
Instantaneous Rail Lift.
Rapid Traverse to All Heads.
Forced Lubrication to the Vees.
Forged Steel Rack.
Steel Gearing.
Box Arch.
Box Table.



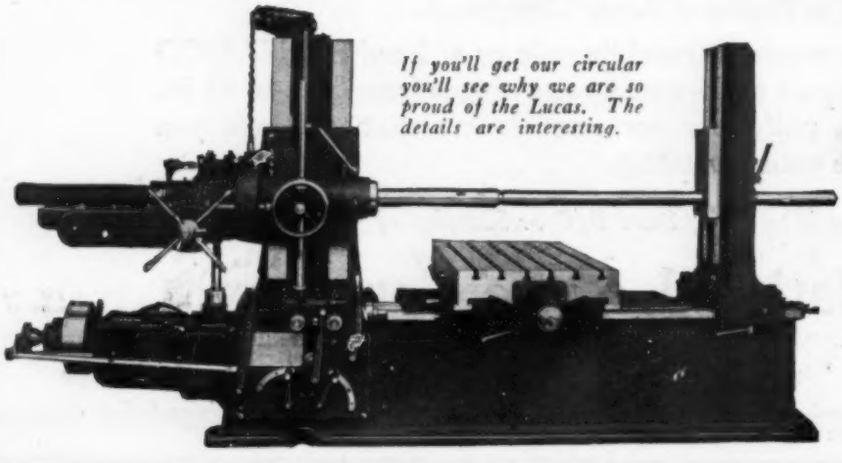
THE CINCINNATI PLANER CO., Cincinnati, Ohio

Cutting the Cost of Rehandling

Set-ups and rehandling on variety work usually add greatly to the cost of machining. The **Lucas** bores, drills and mills with a single set-up and all operations are readily held to the required limits of precision.

You can get exact duplication without the use of jigs or fixtures on the

"PRECISION" Boring Drilling and Milling Machine



If you'll get our circular you'll see why we are so proud of the Lucas. The details are interesting.

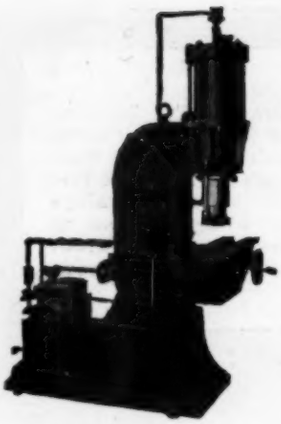
The Lucas Machine Tool Co.

NOW AND ALWAYS OF

Cleveland, Ohio

OILGEAR

Reg. U. S. Pat. Off.



OILGEAR
HYDRAULIC PRESS

Oilgear Straightening, and Combination Broaching and Assembling Presses are setting new production records. They embody the same hydraulic drive principle as the Oilgear Broaching Machine. Smooth, even pressure and stepless speed variation of the ram with 90% working efficiency are features you can't duplicate on mechanical presses. May we send you production data on these machines.

"—it has absorbed the load of 3 other machines"

—excerpt from user's letter

"Our No. 4 Oilgear Broaching Machine has been in continuous use in continuous heavy production since March, 1925. Many of our jobs register the dial at 35,000 lbs. We have experienced no trouble, the machine is always ready for duty, very smooth in action and above all, high in production capacity. In fact it has absorbed the load of three other broaching machines. We are placing the three old machines in storage. The one Oilgear Machine handles our entire output."

Plant after plant is replacing mechanical broaching machines with Oilgear "Hydraulics." They find their smooth action makes a clean, accurate job without chatter under the heaviest cuts and eliminates in many cases the usual light finishing cut necessary with other types of machines.

Each machine is a self-contained unit—no pressure lines to maintain —simply connect to any constant speed source of power and the machine is ready for service.

Our bulletin No. 35 tells the complete story. If you are interested in more production at less cost, send for your copy today.

THE OILGEAR COMPANY
659 Park Street
MILWAUKEE, WISCONSIN

Covered by Basic Patent No. 1,468,595, issued Sept. 18, 1923

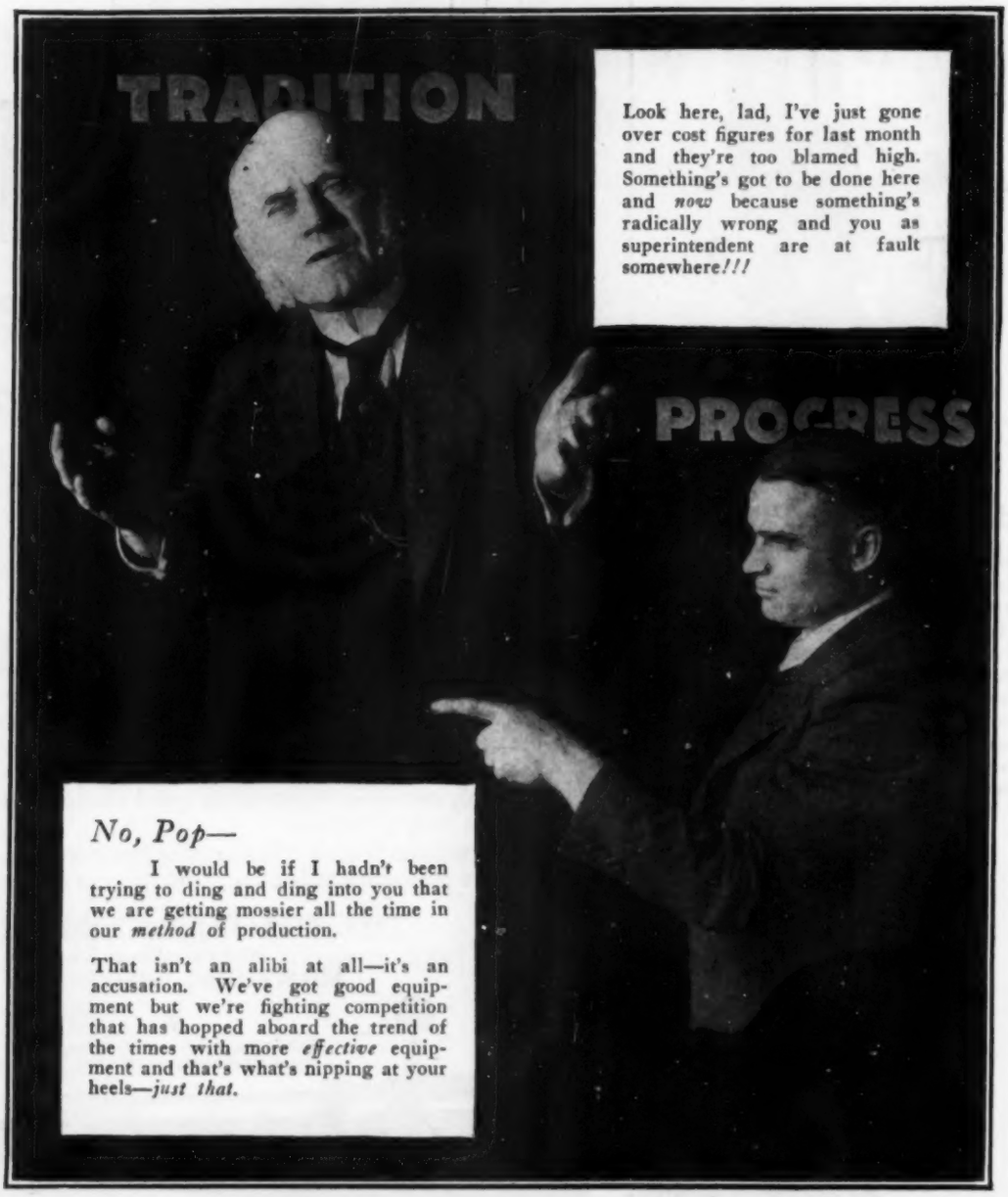
Push button or foot control mechanism at the option of the operator.
Hand lever stops machine at any point in the stroke. Push button starts or reverses ram at ends of stroke.
OILGEAR
Foot lever functions same as push button to leave hands of operator free.

Oilgear Hydraulic Equipment

PRESSES — BROACHING MACHINES — TRANSMISSIONS — PUMPS

The BETTER way

Cost figures are up again


TRADITION
PROGRESS
Look here, lad, I've just gone over cost figures for last month and they're too blamed high. Something's got to be done here and *now* because something's radically wrong and you as superintendent are at fault somewhere!!!
No, Pop—
I would be if I hadn't been trying to ding and ding into you that we are getting mossier all the time in our *method* of production.
That isn't an alibi at all—it's an accusation. We've got good equipment but we're fighting competition that has hopped aboard the trend of the times with more *effective* equipment and that's what's nipping at your heels—*just that.*

build (5)—to increase and strengthen:

to increase the power and stability of:

to settle or establish and preserve:

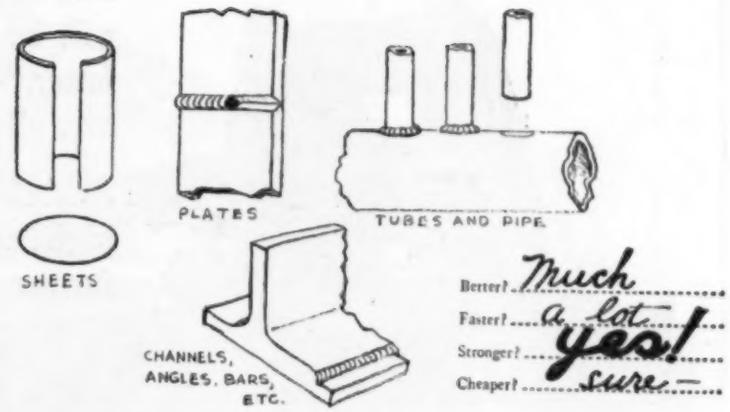
—*Webster*

LINCOLN

is WELDING—*so*

You know that I've repeatedly asked for Stable-Arc Electric Welders to BUILD (see Webster, also sketches) our equipment and your answer has always been "Be careful, young man, about changing horses in midstream." But our chief competitor has changed to a *faster* horse.

And we can't hope to keep pace in the matter of cost.



You haven't been able to *see* then where we could manufacture with welded steel shapes, but you're able to *feel* the effects of not changing.

Page after page in this Lincoln booklet shows where makers of jack spools, machinery bases, axles, generators, building specialties, conveyors, elevators, tanks, boilers, wheels, pipes, trucks, buckets, hangers, and right down to small details of small appliances, have *changed*.

And every single one of them changed because they reduced costs and got a *better* and *stronger* product.

To the reader:—Mark the name of your particular product in the coupon at the right. It may be that Lincoln engineers can put in the mail some cost figures on that very item.

This book, mailed on request, will answer many questions that come up on the subject of this production tool. The coupon is for your convenience in getting a copy.

This book tells how a product such as the electric motor was placed on a higher plane through Stable-Arc welding. Just check it on the coupon if you desire a copy. By stating your company connections we may be able to send you data applying to your particular business.

The Lincoln Electric Co.

Cleveland, Ohio

"Stable-Arc" WELDER

COUPON

3-6-24

LINCOLN ELECTRIC COMPANY, CLEVELAND

Please send to the address below

....The Motor book

....The Stable-Arc Welder book.

Enclose any data you may have on manufacture of a product such as.....

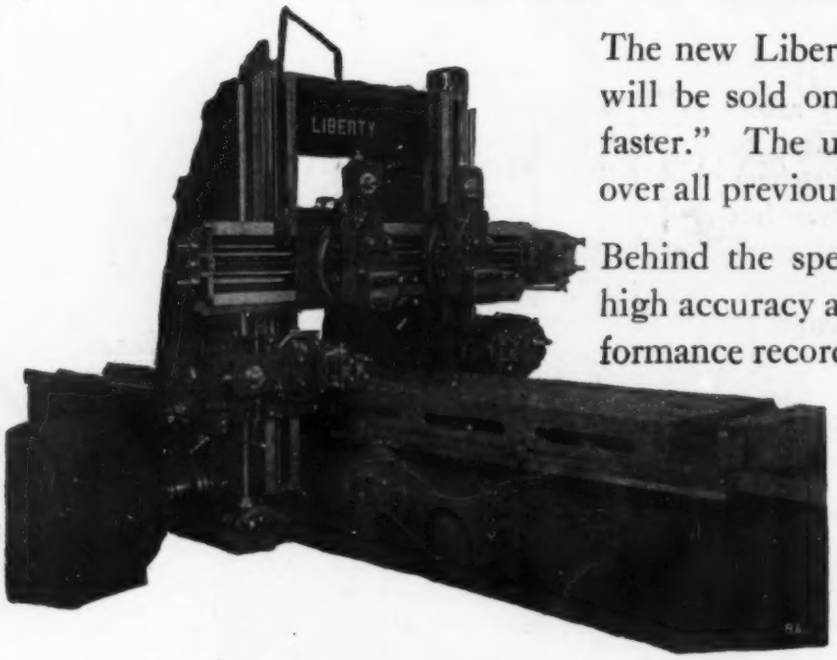
.....

Name .....

Company .....

Address .....

Plane With the New Liberty



The new Liberty Planer is and always will be sold on its ability to "plane it faster." The unit is greatly improved over all previous models.

Behind the speed are the elements of high accuracy and endurance. The performance records of new Liberty Planers in many of the leading plants are available. "Talk With a Liberty Man." He will present facts.

LIBERTY MACHINE TOOL COMPANY
Hamilton, Ohio

CARD TAPS

From the Standpoint of Cost

Buying at a low first cost may mean greater expense in the end. Card Taps demand the market price for high grade tools. A tap costing ten percent more may be fifty percent more economical in use.

Keep a record of the number of tapped holes the quality of the work, speed of operation. Take a percentage here, then compare with first cost.

Card Quality Taps show a real investment on this basis. Catalog No. 31 latest issue.

S.W.CARD MFG. CO.
DIVISION OF UNION TWIST DRILL CO.
MANSFIELD, MASSACHUSETTS, U.S.A.

"The 'Victor' saves us $1250 each year"

WE HAVE frequently told you that LANDIS equipment pays for itself in a short time. Here's more proof.

Something over a year ago the Ohio Brass Co. purchased two 6¾-in. Victor Collapsible Taps.

They put them to work tapping Tomlinson Radial MCB Car Couplers. The threaded portion is 6¾ in. in diameter, leading in for 6¼ in.

Former production with solid tap was six per hour. The Victor cut this time in half, 12 couplers per hour.

The first year on the job the Victor made savings of $1250, and it still continues to keep up the good work.

Victor Collapsible Taps are made in sizes from 1¼ in up—stationary or rotary types.

Test them on your work.

LANDIS MACHINE COMPANY, Waynesboro, Pennsylvania

LANDIS TRADE — MARK

J&L
JONES & LAMSON

The Hartness Flat Turret Lathe equipped with a few simple, inexpensive tools gives to the willing machine operator the opportunity to earn dividends for his employer.

The fact that the J & L operators are enthusiastic over their machines is not only complimentary to the builder but profitable to the owner of the machines.

JONES & LAMSON MACHINE CO., Springfield, Vermont

WHITON
Geared Scroll
Combination Chucks

These chucks are made with either iron or steel bodies and in three or four jaw types. The jaws are reversible and operate universally or independently.

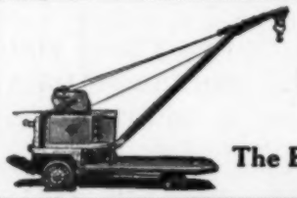
LATHE AND DRILL CHUCKS

Price and dimension list on request

THE D. E. WHITON MACHINE CO.
Established 1856
NEW LONDON CONN.

DICKINSON'S SPECIAL SHAPED CARBON (Black Diamond) TOOLS
For machining Brass, Copper, Bronze, Aluminum, Cast Iron, Chilled Iron and other metals. Maintain their sharp cutting edges for many months of continuous use, insuring exact uniformity of size and shape for large numbers of pieces. The tools are set with Diamonds of Proper Size and Strength to give Satisfactory and Economical Service.

THOS. L. DICKINSON, 38 GOLD ST., NEW YORK CITY
Successor to John Dickinson Established 17[illegible]

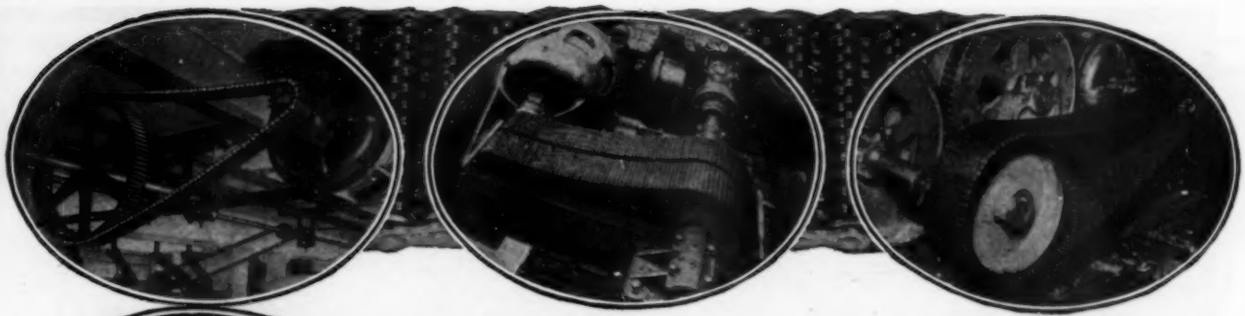


Electric Industrial Crane Truck
One of 25 Types
Each Built for Special
Lift and Carry Service
Request Catalog 811
The Elwell-Parker Electric Co.
Cleveland, Ohio

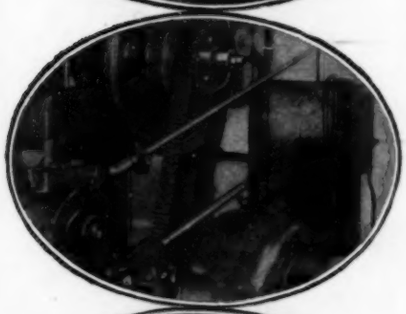
Appearance

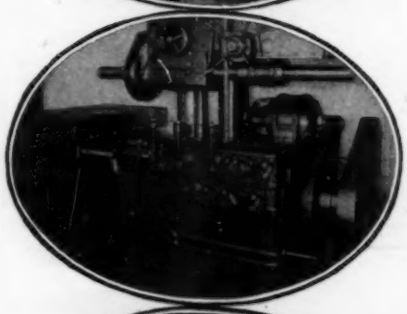
is a sales factor in machine tools. **Rockwood Pressed Steel Machine Handles** are neat, light and uniform in shape. They possess a strength that ably resists any operating strain. Rockwood Handles are hollow and seamless. Made in eleven sizes to meet every handwheel and lever need. Send for samples and prices.

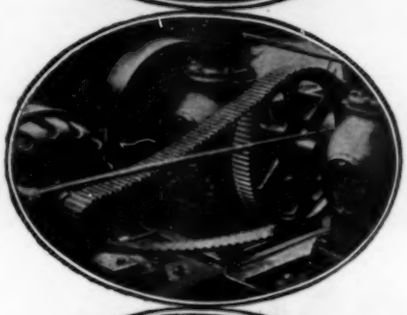
Rockwood Sprinkler Co. of Massachusetts
General Manufacturers of Pressed Steel Products.
Worcester, Mass.
London Office: 147 Queen Victoria St., E. C. 4



"WHITNEY"
SILENT CHAIN DRIVES







Are being installed every day in an endless variety of power transmission applications. The few drives shown here illustrate the interesting diversity of a day's work.

The same advantages, however, apply to all of these various installations. They have all been carefully engineered and painstakingly built to insure maximum efficiency and length of life. They have all been sold because they were selected as the best type of drive for the service.

Whether called upon to transmit one or one hundred horsepower, these drives are EFFICIENT, POSITIVE, COMPACT and DEPENDABLE.

Let our engineers fit the drive to your job.

THE WHITNEY MFG. CO., Hartford, Conn.

SALES AND ENGINEERING OFFICES:

NEW YORK
L. C. Biglow & Co., Inc.
250 W. 54th St.

PITTSBURGH
Pittsburgh Gear & Mach. Co.
27th & Smallman Sts.

BOSTON
The Whitney Mfg. Co.
727-A Boylston St.

CLEVELAND
The Smith
Power Transmission Co.,
1218 Ontario St.

CHICAGO
The Whitney Mfg. Co.
549 W. Washington Blvd.

DETROIT
The Whitney Mfg. Co.
2-240 General Motors Bldg.

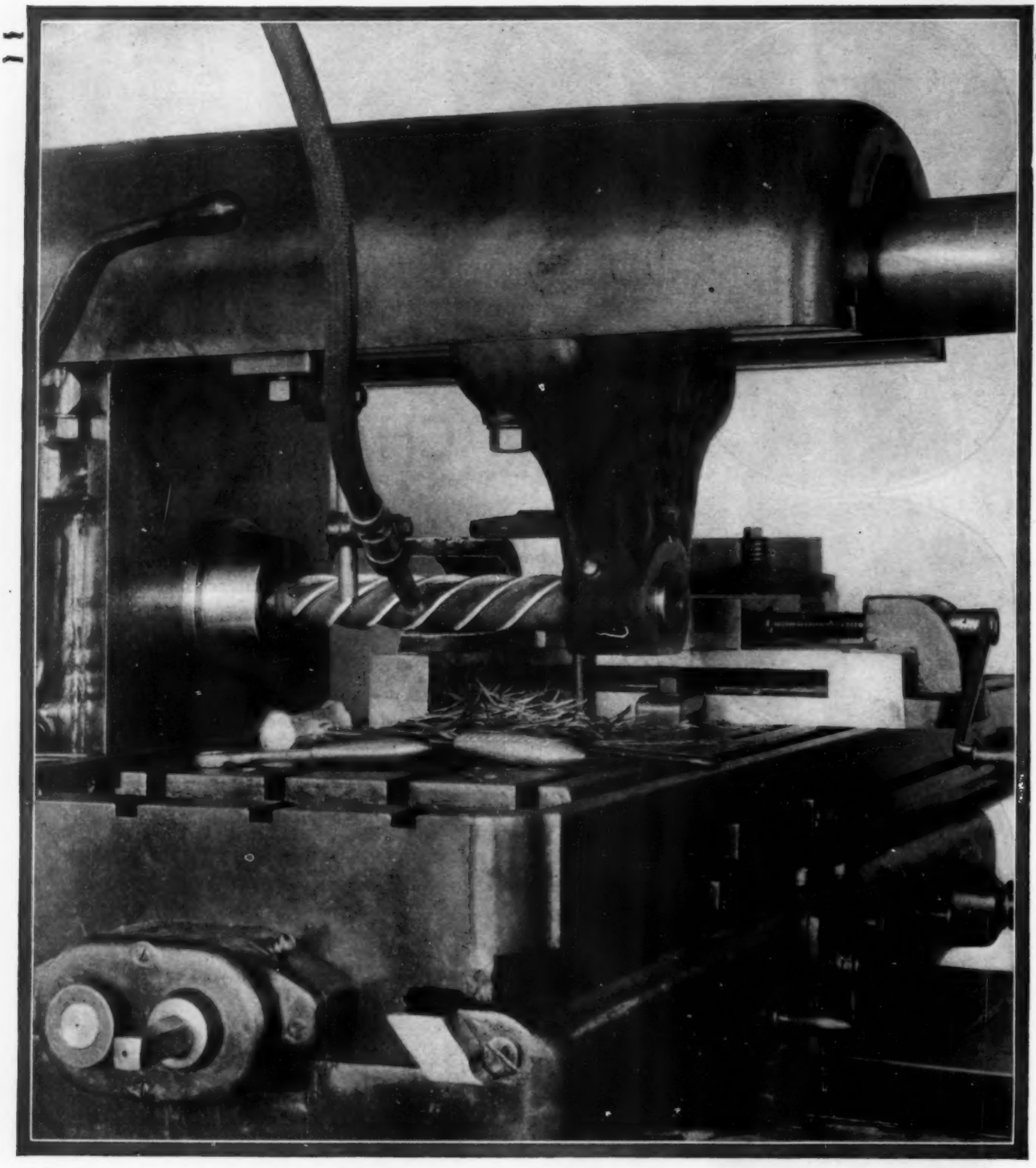
SYRACUSE
George McPherson
201 Norwood Ave.

PHILADELPHIA
The Whitney Mfg. Co.
1505 Race St.

SAN FRANCISCO
A. H. Coates Co.
615 Howard St.

SEATTLE
A. H. Coates Co.
1115 East Union St.

CHAINS AND SPROCKETS FOR POWER TRANSMISSION



RUGGEDNESS

Ruggedness in Brown & Sharpe Milling Machines means more than mere bulk. It means balanced weight scientifically placed where it is needed. It insures a smooth flow of ample power. It makes chatter a negligible quantity. It means faster, cleaner cutting, and consequently high production and lower costs.

Write for specifications of these up-to-the-minute machines.

If you could see the Brown & Sharpe Helical Cutter at work you'd be convinced of its "cut-ability"

IT shears its way along easily in the toughest of steels. In its wake is a smoothly finished surface—before it an increasing pile of clean cut chips, the convincing proof of its "cut-ability."

If it suddenly shears into a deeper bank of metal in the course of the cut, there is no "gouging"—no springing of the arbor. The increased load is taken easily, without straining, and the cut continues steadily.

Let the Brown & Sharpe Helicals shear costs on similar work in your shop.

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

The *New* No. 30 Small Tool Catalog is a handbook of Small Tools and Modern Cutters. It describes over 1500 sizes and styles of Cutters and Hobs and contains considerable cutter information. It will *profit* you to write for your copy today.

Your Ceaseless Search

In the mind of every production and technical man who is alive to his job lives the unceasing search for better ways of accomplishing the work of the shop—

An untiring study of machines, tools, and methods to determine whether the process of manufacture can be improved in time, quality and human energy.

Superintendents and production managers in recent letters to American Machinist tell how ruthlessly they scrutinize every machine to discover whether it is producing 100%, whether it is paying proper dividends on its overhead and operating cost, or whether it should be junked.

And they testify to the real value of American Machinist Advertising and Editorial pages in giving data on new machines and tools—

Particularly—

The tremendous value of the Semi-Annual Shop Equipment Review and Catalog Number, in which manufacturers always give a *complete condensed catalog* of their products as a comprehensive guide for planning and buying.

The next Semi-Annual Shop Equipment Review and Catalog Number is only three weeks away.

July 15 is the date. Watch for it. It will surpass its predecessors, both in editorial and advertising pages.

July 15!

Let me tell you this

"for time saving and tool saving, any shop doing a wide range of work — 6 inch to 9 inch, 9 to 12, 12 to 16, 16 to 20, 20 to 24, or 0 to 24 inches —will find this No. 224, with its interchangeable anvils, just about fills the bill. Accurate? Well, it's a Starrett, isn't it?"

Ask your dealer to show you. Send for Catalog No. 23 "C".

THE L. S. STARRETT CO.
World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS.

STARRETT TOOLS · STARRETT HACK SAWS CUT QUICKER LAST LONGER · STARRETT TAPES

Use Starrett Tools

9290

The Super Picks Some High Spots in the Ads.

There are two kinds of high spots for us in these ads each week. One has to do with ads on equipment for which we are in the market. The other kind contain suggestions on ways and means of doing work that we can turn to our advantage. Let me illustrate.

I have had in the back of my mind, my maintenance department's request for machine tool equipment so it will be unnecessary to call upon the production tool room for the regular run of machine repair work. The request is a valid one which we shall grant if we can find equipment that is not too expensive. And here, in these ads, I've found the very thing we need in a combination machine that includes ability to turn and bore, to mill horizontally or vertically and to drill, ream, and tap, in short a lathe, a milling machine and a drill in one.

We shall purchase one of these machines to fill an existing need. Incidentally, we shall thus remove one of our most irritating maintenance—toolroom alibis.

That's a high spot of the first variety. Here is one of the second which, by the way, is exceptionally well stated. It deals with a problem in gear production and the question of putting up an addition to the gear department building. It is almost decided to go ahead when the department foreman shows that it was better equipment, high-speed gear shapers in this case, that is needed instead of more space. He proves, in fact, that with the particular machine shown in this ad, he can turn out more work than ever in much less space than he has at present.

There's a thought for us that makes me wonder how much of our factory building extension could have been saved in the past for investment, instead, in up to date equipment like this gear shaper.

Returning for a minute to our maintenance man and his many problems, here's an ad that is of practical interest to us. Here is a steel stringer that can be used for securing shaft hangers, and for overhead construction and that does not require the drilling of any holes or chipping of concrete. It should eliminate many hours of costly millwright work for us. We shall give it a trial and see.

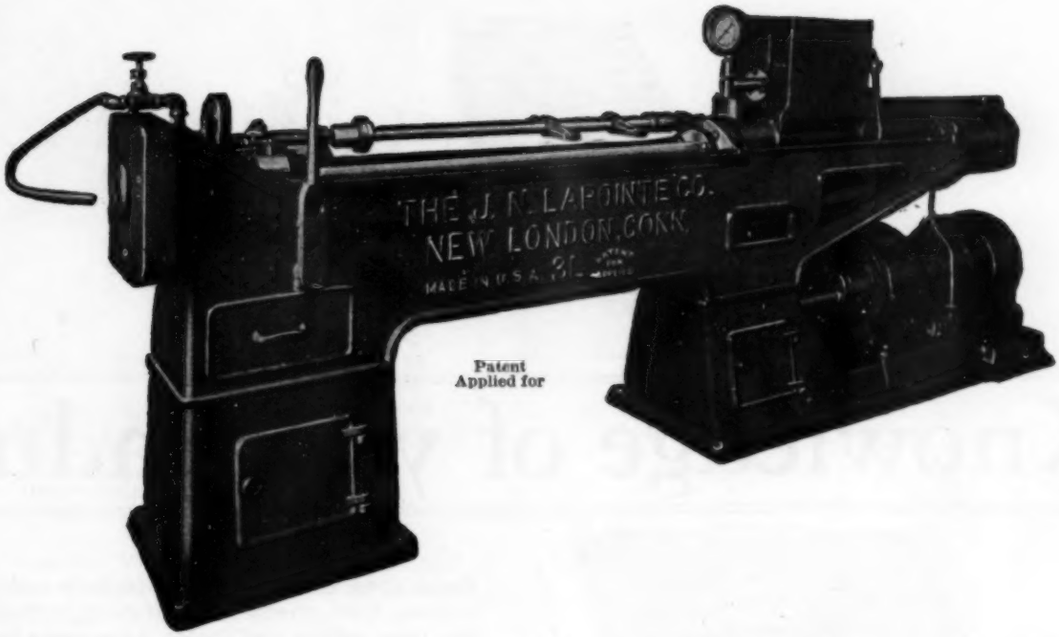
And here is yet another for the millwright department in the shape of a portable hydraulic forcing press. I have an idea that it could be taken to many of our jobs a good deal easier than the way we now carry our parts about the shops, and with a good deal less of "production blocking" on the way.

Speaking of hydraulic presses, with production now in mind, here's another ad on hydraulic equipment with oil for the pressure medium. The main part of this ad is a broaching machine but the "high spot" for me is the illustration of that compact little press shown to one side. The ad says that it can be used for straightening, broaching and assembling. We are going to need one or more of those machines directly.

Directly? Yes. And as a matter of fact, we had better get the department heads together now for the week's discussion of these high spots and others I have gathered from the ads.

Call them now? Yes, if you please. We will just pass an appropriation request or so that I know will mark another notch from our production and maintenance costs.

I certainly do value these advertising pages for the high spots they carry for us.



It's Not a Question of More Men

J. N. Lapointe Co. Hydraulic Broaching Machine

PROFITS are based on men and machines. If your equipment is such that only a skilled operator can get the quality and quantity demanded to keep up to schedules, it's time to replace with modern units.

The new J. N. Lapointe Co. No. 3L Variable Speed Hydraulic Broaching Machines are mechanical masterpieces. They are full 93% efficient and require far less power than other units of their type.

In regular daily operation they have increased production from 50% to 25% —a factor of interest to every production engineer.

The draw rod of the No. 3L has a stroke of 56-in. with a control of speed from 0 to 24-ft. per minute. Return speeds range from 10-ft. to 180-ft. Speed changes can be made while machine is running or idle. It can be stopped and started in any position and the length of the stroke is controlled automatically. Only two pipes are used on the entire hydraulic system. These are extra heavy copper, not more than 27-in. long.

A low pressure relief valve is provided on the return stroke which automatically opens should the ram meet with undue resistance. This feature prevents broach breakage.

Another time saving feature added to this machine is the removable chip pan located in the front part of the machine bed. The coolant washes the chips from the tool down into this pan which is perforated to allow the coolant to drain off into the reservoir below. Only a few seconds are required to remove, empty and replace the pan.

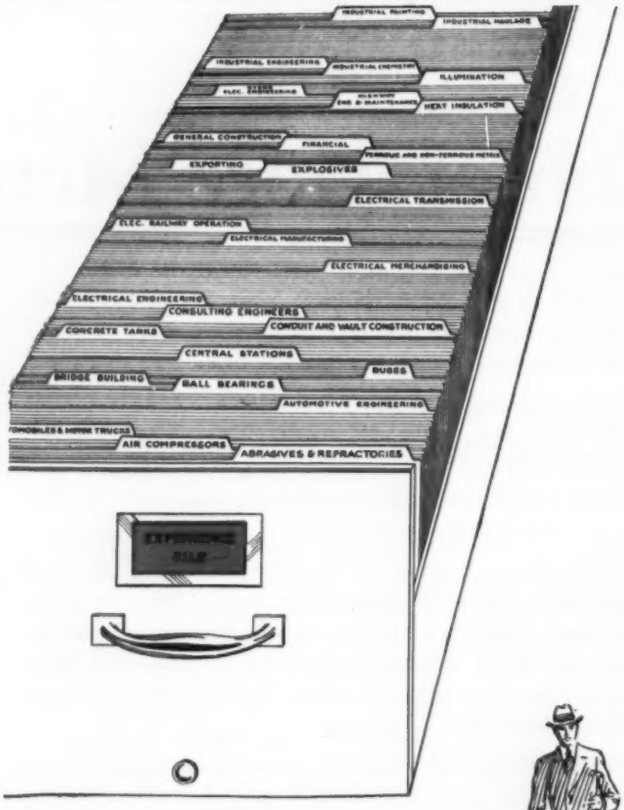
Our illustrated circular 35 describes this new unit in detail. It will be worth your while to send for it.

We manufacture High Speed and Carbon Steel Broaches. Send blue prints for quotations.

J. N. LAPOINTE CO. of NEW LONDON, CONN.

Makers of Broaching Machines and Broaches.

Knowledge of your industry



A Few Facts From The Experience Index

Going through the McGraw-Hill experience file at random you will find such facts as these:

5 McGraw-Hill men formerly in automotive engineering.

8 McGraw-Hill men formerly in material-handling engineering.

2 McGraw-Hill men formerly in subway construction.

12 McGraw-Hill men formerly with process (chemical) industries.

9 McGraw-Hill men formerly in electrical merchandising.

4 McGraw-Hill men formerly consulting engineers.

16 McGraw-Hill men formerly with central stations.

9 McGraw-Hill men formerly with electric railways.

6 McGraw-Hill men formerly machinery designers.

And so on.

From shop and mine, from factory and generating station, from chemical laboratory and construction job, from jobber and dealer, have come the men who make the McGraw-Hill organization. Production men, operating experts, specialists in selling from many industries have come to develop the McGraw-Hill Publications as authorities in industry..... authorities, first, to their subscribers, the creators and builders of industry.....authorities, next, to the men who are selling to industry.

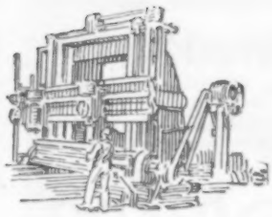
As editors, department heads, service men, marketing counselors and field representatives, these men have become essential units in the McGraw-Hill organization, absorbing its purpose and spirit and devoting their fine attainments to carrying forward its tradition of over a half-century's service to industry.

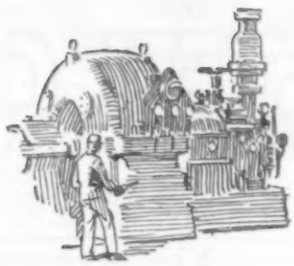
The experience of these men has been cataloged, classified and filed for instant reference. That file is the nerve center of the organization. Thumb over the index tabs and it will be strange if you do not find a man, or twenty men, who have a working knowledge of the industry to which you sell, or the equipment which you make.

For more than fifty years the McGraw-Hill Company has known industrial America. Its contacts have been inside contacts; its fund of experience is the composite gained in shop, factory and field.

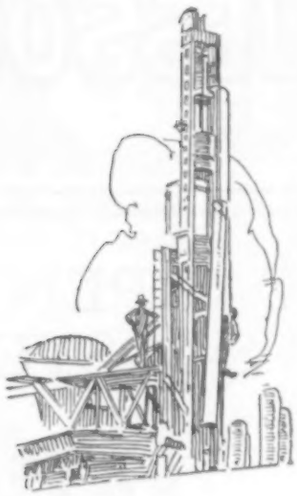
Through this intimate knowledge and constant contact, McGraw-Hill seven years ago sensed the step that industry is now taking in applying to its selling the same science and caution that have advanced industrial production and reduced costs. The service of McGraw-Hill Publications was extended to embrace not only the publishing of technical information on production and engineering but counsel on scientific, waste-free selling. This counsel is epitomized in the following McGraw-Hill Four Principles of Industrial Marketing which today are bringing country-wide endorsement from industry, bank, advertising agency and university.

MARKET DETERMINATION—An analysis of markets or related buying groups to determine the





is here!



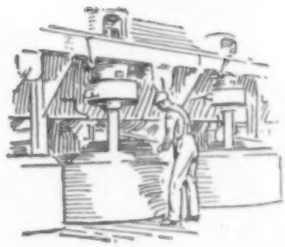
potential of each. With a dependable appraisal of each market, selling effort can be directed according to each market's importance.

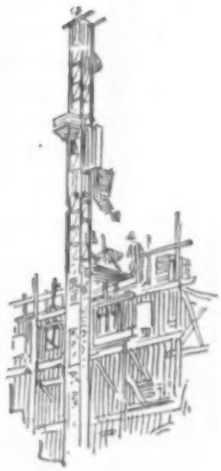
BUYING HABITS—A study of the selected market groups to determine which men in each industry are the controlling buying factors and what policies regulate their buying. Definite knowledge eliminates costly waste in sales effort.

CHANNELS OF APPROACH—The authoritative publications through which industries keep in touch with developments are the logical channels through which to approach the buyer. In a balanced program of sales promotion these publications should be used effectively and their use supplemented by a manufacturer's own literature and exhibits.

APPEALS THAT INFLUENCE—Determining the appeals that will present the product to the prospective buyer in terms of his own self-interest or needs.

These Four Principles are more than a formula. They are a method, repeatedly tested by practical application, backed by a half-century of intimate acquaintance with industry. Any manufacturer selling to industry can apply them to advantage in his own marketing program. Our Marketing Counselors will be glad to lay the details before you or your advertising agent. A conference can be arranged by communicating with our nearest office.





McGRAW-HILL PUBLISHING COMPANY, INC., NEW YORK, CHICAGO, PHILADELPHIA, CLEVELAND, ST. LOUIS, SAN FRANCISCO, LONDON

McGRAW-HILL PUBLICATIONS

45,000 Advertising Pages used Annually by 3,000 manufacturers to help Industry buy more effectively.

CONSTRUCTION & CIVIL ENGINEERING
ENGINEERING NEWS-RECORD
SUCCESSFUL METHODS

ELECTRICAL
ELECTRICAL WORLD JOURNAL OF ELECTRICITY
ELECTRICAL MERCHANDISING

INDUSTRIAL
AMERICAN MACHINIST INDUSTRIAL ENGINEER
CHEMICAL & METALLURGICAL ENGINEERING
POWER

MINING
ENGINEERING & MINING JOURNAL
COAL AGE

TRANSPORTATION
ELECTRIC RAILWAY JOURNAL
BUS TRANSPORTATION

OVERSEAS
INGENIERIA INTERNACIONAL
AMERICAN MACHINIST
(EUROPEAN EDITION)

RADIO
RADIO RETAILING

CATALOGS & DIRECTORIES
ELECTRICAL TRADE CATALOG
RADIO TRADE CATALOG
KEYSTONE CATALOG (COAL EDITION) KEYSTONE CATALOG (METAL-QUARRY EDITION)
COAL CATALOG CENTRAL STATION DIRECTORY
ELECTRIC RAILWAY DIRECTORY
COAL FIELD DIRECTORY
ANALYSIS OF METALLIC AND NON-METALLIC MINING, QUARRYING AND CEMENT INDUSTRIES

JESSOP
"Shock Resisting Steel"

JESSOP'S SHOCK RESISTING STEEL—a tough steel with the stamina to resist the hard service of Pneumatic Chisels, Rivet Snaps, Bending Tools, etc.

Like all Jessop Steel Company's steel, it is made of pure Swedish Iron, alloyed and worked to exacting Sheffield standards by skilled steel workers, supervised by experienced men who know fine steel making.

Write for Catalog

JESSOP STEEL COMPANY
WASHINGTON, PENNSYLVANIA

Offices and Warehouses at:
NEW YORK, N. Y. 52 West St.
CHICAGO, ILL. Fulton & Jefferson Sts.
DETROIT, MICH. 2208 Fort Street, W.
LOS ANGELES, CAL. 639 South Spring St.
BIRMINGHAM 711 Second St.
ST. LOUIS, MO. Walter G. Clarke, Inc., 215-217 Chestnut St.
CINCINNATI O. 13 E. Second Street.
CLEVELAND, O. 1277 W. Ninth Street.
NEW ENGLAND Industrial Steels, Inc., 292-298 Main St., Cambridge, Mass.
CANADIAN OFFICE & WAREHOUSE, HAMILTON, ONT., 50 King Wm. St.

CARPENTER S-M STEEL

This remarkable alloy tool-steel, when suitably hardened and toughened for heavy punching, shows physical strength well in excess of 300,000 pounds per square inch and is, in this condition, almost unbreakable. It will stand extraordinary abuse.

Try it on that difficult production job.

Warehouses in:
CHICAGO CLEVELAND DETROIT HARTFORD INDIANAPOLIS READING

THE CARPENTER STEEL COMPANY
READING, PA.

Our Hollow Bored Forgings and Steel Shafts
Are RIGHT in both QUALITY and PRICE

Piston Rods *Rams*
Clutch Shafts *Steel Pipes*
Lathe Spindles *Etc., Etc.*

Send along your blueprints with a trial order; we'll both be pleased.

AMERICAN HOLLOW BORING CO.
1905 Raspberry St., Erie, Penna.

Steel of Every Description
HAWKRIDGE BROTHERS COMPANY
303 Congress Street Boston, Mass.

ELECTRIC TOOL STEEL
High Speed Carbon
Highest Quality—Best Practice
Latrobe Electric Steel Co., Latrobe, Pa.

Vulcan
CRUCIBLE STEEL COMPANY
Aliquippa, Pa. Established 1900

Wolfram High Speed, Vulcan Special, Vanadium, Straight Carbon and Special Steels. Uniformity and Vulcan are synonymous.

GOVERNMENT GENUINE BABBITT

Will stand the most persistent punishment and come through smiling. *Ask your dealer—or ask us.*

Made by the Makers of the Famous Autocrat Bushing Bronze—UNITED AMERICAN METALS CORP'N, BROOKLYN, N. Y.

VASCO

"SPECIAL" TOOK 25% OFF Their Tool Steel Overhead

THE FACTORY MANAGER OF A LARGE PLANT OF A DETROIT AUTOMOBILE ACCESSORY MANUFACTURER IS RESPONSIBLE FOR THIS STATEMENT COVERING THE PERFORMANCE OF VASCO SPECIAL TOOL DIES:—

"We use milling and reaming cutters of Vasco Special for cutting cast iron, and on clip presses for cutting hoop steel and cut offs for cutting strip steel. With ordinary steels the dies had to be reground every 9 hours whereas with Vasco Special we grind them only every 12 hours. The savings in grinding labor—due to fewer grinds—we estimate amounts to 30 hours per machine per year, or 180 hours for the six machines.

"The steel supplied by the Vanadium Alloys Steel Company has always been very uniform and the co-operation and assistance given us by their representatives has enabled us to perfect our annealing, hardening, tempering and grinding so that these vital factors for successful results have been properly handled."

(From a Certified Performance Survey made by the A. C. Nielsen Co.)

Why not let the Vasco representative in your territory co-operate with you, too, on your difficult die steel applications?

Vanadium-Alloys Steel Company

LATROBE, PENNSYLVANIA

Columbia
TOOL STEEL

FINE STEELS made by the CRUCIBLE PROCESS

CLARITE HIGH SPEED STEEL
OILDIE NON-SHRINKING
COLUMBIA SPECIAL CARBON TOOL STEEL
COLUMBIA EXTRA, ETC

It pays to use Good Tool Steel.

COLUMBIA TOOL STEEL COMPANY

MAIN OFFICE AND WORKS, CHICAGO HEIGHTS, ILLINOIS

CHICAGO · DENVER · LOS ANGELES · PORTLAND · SAN FRANCISCO
CINCINNATI · DETROIT · MILWAUKEE · ST. LOUIS · SEATTLE
CLEVELAND · KANSAS CITY · NEW ORLEANS · ST. PAUL · WORCESTER

Aluminum, Manganese and Phosphor Bronzes

Ours has been one of the best known non-ferrous foundries in the industry since 1900, and ever since we have been consistently pouring castings of cast aluminum, phosphor and manganese bronzes, and bearing metals.

Some of the most prominent users of high-grade aluminum castings, cast bronzes and bearing metals are our regular customers, and have been for many years.

Our machine shop has exceptional facilities for the production of complete units, clutches, transmissions, gears, shafts and various parts.

Let us give you a quotation from your samples or blue prints.

LIGHT Manufacturing & Foundry Co.
Pottstown, Pa.

Model C

For Rapid and Unerring Measurements

Volume production of interchangeable parts requires rapid and precise checking. **Randall & Stickney Model C Dial Gauges** were designed to meet modern needs. May be readily attached to practically all machines or used in connection with surface gauges. They have a ½-in. range.

Ask for the full set of Bulletins covering the **Randall & Stickney** line of **Dial Measuring Instruments.**

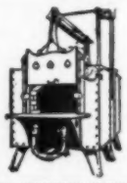
Randall & Stickney
Waltham, Mass.
Makers of Gauges over 40 years

AMERICAN GAS FURNACE CO. — PIONEERS IN 1878 — LEADERS TO-DAY

Forges, Blowpipes, Gas Blast Burners, Furnaces and Heat Treating Machines for every industrial purpose.

Bulletin A.M.20 on reqvest.

American Gas Furnace Co.
Office and Works: **Elizabeth, N. J.**



SC & H
Industrial Furnaces and Furnace Room Accessories

The Strong Carlisle & Hammond Co.
Cleveland, Ohio

New York
Chicago
Philadelphia
Boston
San Francisco

BUNTING
PHOSPHOR BRONZE
BUSHING BEARINGS

300 Sizes—Always in Stock.

THE BUNTING BRASS & BRONZE CO.
TOLEDO

FRANKLIN DIE-CASTINGS

We cast in Aluminum, Tin, Lead and Zinc base alloys. Estimates made from samples, drawings, or blue prints. Send for booklet.

FRANKLIN DIE-CASTING CORPORATION
Gifford and Magnolia Streets, Syracuse, N. Y

MAGNOLIA
ANTI-FRICTION
BEST BY U.S. GOVERNMENT TEST
METAL

MAGNOLIA METAL CO. 113 BANK ST. NEW YORK

General
Automatic Labor-Saving Equipment Throughout

GENERAL DIE CASTING CO.
Reading, Penn.

NONSKORE BRONZE HEVEDUTY

The wonder bearing metal. Will not score the shaft, and will stand high temperatures. And runs with a minimum of oil. Made in stock bars, finished bushings or to your patterns.

SPECIALTY BRASS CO., Kenosha, Wis.—Albion, N. Y.

Stewart Die Castings
Send Blueprints for Estimates

STEWART DIE CASTING CORP.
4505 Fullerton Ave., Chicago

JESSOP'S STEELS
GENUINE SHEFFIELD
for Tools of Every Description

Branches and Stocks in All Principal Cities

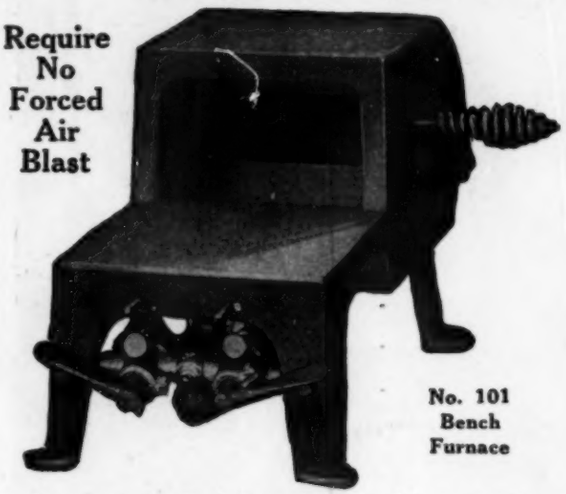
William Jessop & Sons, Inc.
Head Office, 91 John Street, New York

SOSS
DIE CASTING SINCE 1908

Send blueprints for estimates
SOSS MANUFACTURING CO.
Grand Ave. and Bergen Street, Brooklyn, N. Y.

JOHNSON Gas Heat-Treating Furnaces

Require No Forced Air Blast



No. 101 Bench Furnace

The Johnson No. 101 Bench Furnace is designed for small work, or as an auxiliary to the larger Gas Furnaces.

It has two independent Atmospheric Burners, each with shut-off valve and pilot.

This Furnace will quickly melt small quantities of soft metal and will heat soldering coppers up to 12 lbs. a pair.

Write for complete catalog.

It lists a complete line of heat-treating and melting furnaces and various gas appliances none of which require a *forced air blast or blower. Keep it for handy reference!*

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

Firestone and Taylor

The Firestone Steel Products Co., Akron, Ohio, uses Taylor Spot Welders to keep production at the peak! They know from experience the ease and economy of operation resulting from these pioneer welding machines.

No matter what the task, Taylor Welders will weld it better! Ask particularly about the new "N" Type Taylor, built for 24-hour duty!

The Taylor Welder Co., *Warren, O.*

TAYLOR
SPOT WELDERS

Cut your welding costs

WELDIT GASAVER

With the Weldit Gasaver you burn gas only when the torch is in actual use. The rest of the time it hangs on the projecting arm—with the flow of oxygen and acetylene positively stopped. A pass over the pilot light relights the torch with the original adjustment.

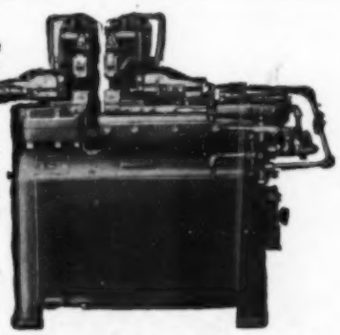
Weldit Gasaver will cut your gas consumption at least 25%—a worth while saving that you should know more about. It is advisable to specify kind of apparatus being used when ordering a Gasaver.

Send for complete particulars.

WELDIT GASAVERS HAVE BEEN APPROVED BY THE NATIONAL BOARD OF UNDERWRITERS.

WELDIT ACETYLENE CO.
636 Bagley Ave., Detroit, Mich.

OUR wide experience in the practical problems of welding, plus the widest variety of Stock Welding Machines to fit every type of work, is the reason for Thomson leadership in this field.



Catalog and engineering help gladly extended upon request.

THOMSON ELECTRIC WELDING CO.
1886 *"Pioneers in the Art of Resistance Welding"* 1926
361 Pleasant St., Lynn, Mass.

IMPERIAL WELDING AND CUTTING EQUIPMENT
OXY-ACETYLENE PROCESS

A new mixing principle, accurate regulation of gases, eight torches in ONE—are exclusive IMPERIAL features. The Imperial Generator makes acetylene 2 to 4 cents cheaper per foot than you can buy it. Write for catalog.
Imperial Brass Mfg. Co., 1214 W. Harrison St., Chicago

The Superior Quality of "FEDERAL" WELDERS
Has Never Been Questioned

Complete line of electric spot, butt and seam welders, standard or special

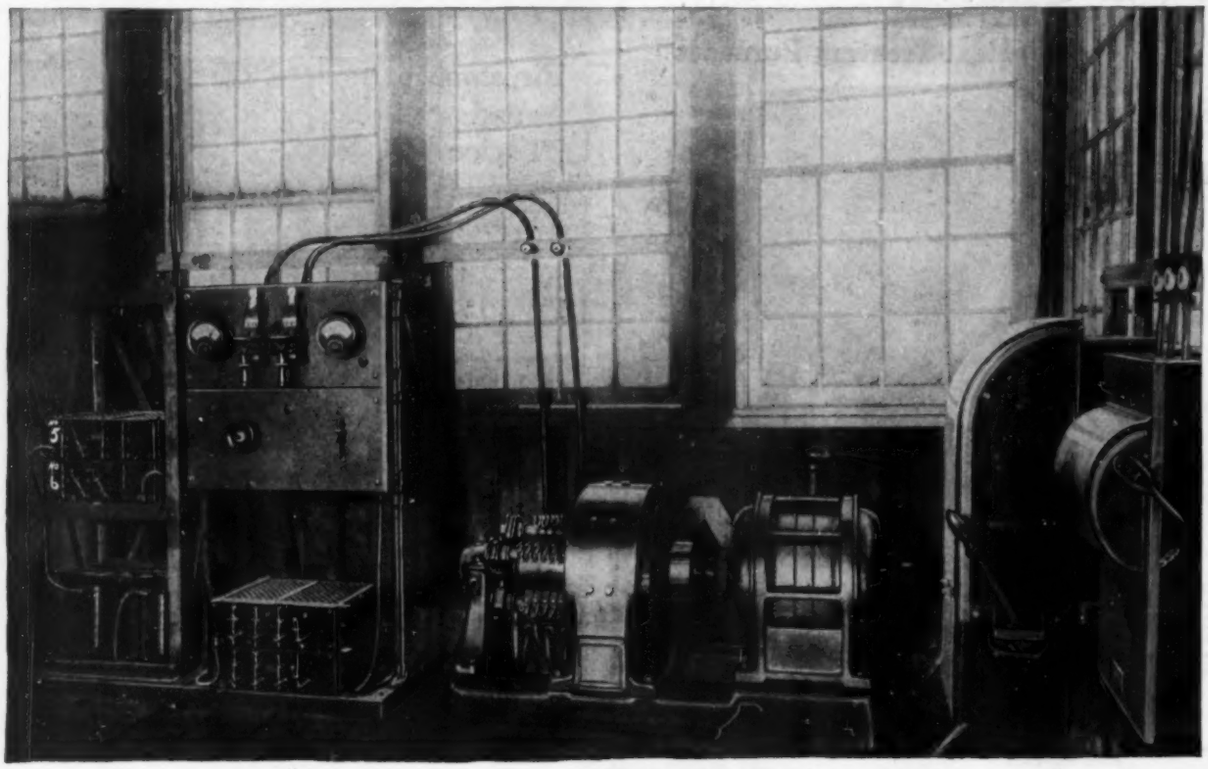
The —Federal— Machine and Welder Co., Warren, Ohio

Recognized leaders in the development and production of resistance welding machines.

Acme Spot Welder

Low in Price **High in Efficiency**
All Styles and Sizes **Immediate Delivery**

ACME ELECTRIC WELDER CO.
PHILADELPHIA, Bourse Bldg.
CHICAGO, 817 W. Washington Blvd.
LOS ANGELES, 5615 Pacific Blvd.
Agents in all Principal Cities



Arc Weld!

4 welders work from this one machine. It is a G-E Constant Potential welding set installed at the plant of the Coshocton Iron Co., Monongahela, Pa. If this set were not used, 4 individual welding sets would have to be purchased; 4 individual welding sets would have to be maintained.

G-E Constant Potential sets are compact, highly efficient "central stations" for welding on a large scale. They save the price of a large number of individual welders. Because there are fewer brushes, fewer bearings, and fewer rotating parts, their maintenance is far less than that of the welders they replace. Investigate these multiple-operator welders whenever you plan quantity welding.

G-E welding specialists will help you choose the welding equipment best suited for your needs. Write to your nearest G-E office.

General Electric furnishes to the Welding Industry:

- WD Arc Welders—designed for one operator
- Constant Potential Sets—for several operators
- Arc Welding Resistors—for mining and traction companies
- Automatic Sets—for repetition work

Bulletins on every type available at your nearest G-E office.

530-6

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL PRINCIPAL CITIES

Globe Polished

and

Blue Chip

High Speed

DRILL RODS

Quality Accuracy
Uniformity

FIRTH-STERLING
STEEL COMPANY
McKeesport, Pa.

NEW YORK BOSTON HARTFORD PHILADELPHIA
CHICAGO CLEVELAND DETROIT
SAN FRANCISCO LOS ANGELES

W-11

Of Vital Interest to Manufacturers

The ever-increasing demand for alloys of a fixed standard of uniformity and excellence is fully met by

Elephant Brand

PHOSPHOR BRONZE

The introduction of Phosphorous into its composition reduces any oxides dissolved therein and forms with the purified metals a most homogeneous and regular combination, the hardness, strength, toughness, rigidity and elasticity of which are completely under control.

A grade for every requirement
Literature and full particulars sent on request.

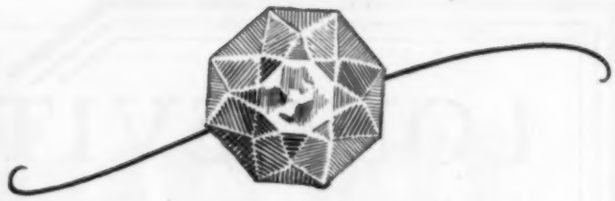
THE PHOSPHOR BRONZE SMELTING CO.
2200 Washington Avenue, Philadelphia, Pa.

HIGH SPEED TOOL STEEL

Being the pioneers in this grade of steel we have a grade that will best meet your requirements.

Send for our book on High Speed Steel.

LUDLUM SPECIAL STEELS — STEELS SPECIAL PURPOSES



Rivaling the Diamond in hardness—

Pure chromium is the hardest commercial metal known. It is harder than case hardened steel. The electrolytic application of a thin coating of pure chromium, thoroughly covering the surface of the plated article, gives great additional protection, not only against scratching, abrasion and wear, but against chemical and atmospheric corrosion, for not only is chromium hard, but it is unaffected by alkalies, chemicals, moisture or acids (except hydrochloric and hot sulphuric).

Chromium plating is not expensive though it is a quality product. A CR-plated article has a higher market value because of its durability and beauty—CR-plated equipment is invaluable to the user, and its application may mean great savings to the manufacturer by minimizing wear on machinery and by increasing the production efficiency of finely machined parts.

We shall be glad to assist you in considering your particular problems.

CHROMIUM PRODUCTS CORPORATION
120 Broadway, New York
WORKS:
92 Bishop Street, Jersey City, N. J., U. S. A.

Your sales points

Hardness
Appearance
Rust-Resistance
Permanence

CHROMIUM PRODUCTS CORPORATION — CR PLATE — TRADE MARK

Resistance to Chemical Action
Resistance to High Temperatures
Economy

CHROMIUM PLATING

The new
PROTECTIVE SURFACING
for your product

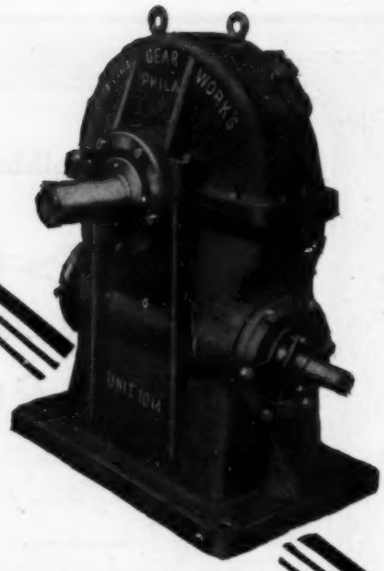
LONGEVITY

All Philadelphia Speed Reducing Units, Whether Worm, Herringbone or Spur Gear Types, are built to give long service life, with minimum upkeep cost. They are not the cheapest units in first cost, but they ARE the most inexpensive in the final analysis.

The reasons for the long life rendered by Philadelphia Speed Reducing Units may be briefly summarized as follows:

(1) Over 40 years of Gear Making experience.
(2) Use of highest grade materials.
(3) Extremely accurate workmanship.

Our completely illustrated catalog sent upon written request on your business letterhead.



The unit shown above is the Type A. P. No. 1014 Philadelphia Worm Gear Speed Reducing Unit.

Main Office and Plant Richmond and Tioga Sts. Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

Branch Sales and Engineering Office: 12 E. 41st St., New York

Our Other Products

Spur, Bevel, Mitre, Herringbone, Internal Spiral, Intermittent and Worm GEARS.

Micarta, Fabroil, Textolite, Celeron and Rawhide GEARS AND PINIONS. Chains, Sprockets, Racks, Ratchets and Pawls.

Spiral Bevel Gears

—25-inch Spiral Generator

For all installations requiring smooth and efficient transmission of power use Spiral Bevel Gears.

Spiral Bevel Gear Generators are built in four sizes.

4 inch, 15 inch, 25 inch, 90 inch

Straight Bevel Gear Cutting Machinery also built

6 inch to 192 inch capacity

GLEASON WORKS
Rochester, N. Y. U. S. A.

Manufacturers of Gears and Bevel Gear Machinery for over sixty years.

Nuttall

Something out of the ordinary

This is a graphic illustration of Nuttall's ability to design, and facilities to manufacture unusual gearing for special service. We are completing 22 sets of steel, helical, ball mill drives like this, about 5 to 1 ratio,—gear 282 teeth, pinion 19 teeth, $1\frac{3}{4}$ D.P. 18 in. face.

Perhaps you have some difficult problem or requirement on which you can benefit by using our long experience and diversified facilities. Gears up to about 108 in. O.D. can be BP treated, making them as nearly unbreakable and wear-proof as gears can be made, and, if they are helical, as nearly noiseless and vibrationless.

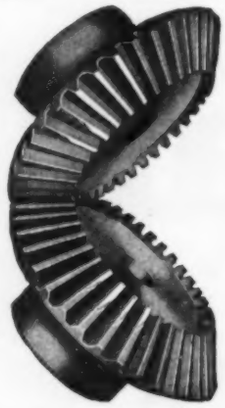
All Nuttall BP Gears are guaranteed to outlast four untreated gears in identical service—a saving of about 70% in gear cost.

R.D. NUTTALL COMPANY
PITTSBURGH PENNSYLVANIA

Chicago Office:
2133 Conway Bldg.

Philadelphia Office:
Westinghouse Building
30th and Walnut

Canadian Agents: Lyman Tube & Supply Co., Ltd., Montreal, Toronto



You can rely on us—

If there is one thing more than another that we pride ourselves on it is the ability to fill your gear wants with complete satisfaction.

Satisfaction of course, means a quality product at fair prices, delivered right when you want it—*something* we've been doing for the last 49 years.

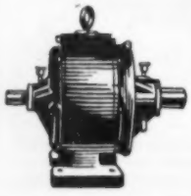
Our complete stock of ready-cut gears will save you both time and money.

"Specials to your specifications or ours." Write for prices.

GRANT GEAR WORKS

B AND SECOND STREETS, BOSTON, MASS.

Ganschow
SPEED TRANSFORMERS



Direct, Angle or Vertical Drive Spur Gear Speed Transformers. Also Worm Gear and Compound Units. Write for Catalog No. 111.

William Ganschow Company
1011 West Washington Blvd., Chicago

BIRMINGHAM · BOSTON · NEW YORK · DETROIT · SALT LAKE CITY · SEATTLE · SAN FRANCISCO · PHILADELPHIA

WE HAVE THE PATTERN for that HURRY-UP ORDER

7000 patterns ready for use.

CAPACITY

SPUR GEARS—144 in. Diameter
BEVEL GEARS—56 in. Pitch dia.
WORM GEARS—46 in. Pitch dia.
WORMS—12 in. PD., 3½ in. CP.
RACKS—3½ in. CP.

Write for list of HOBS

The Simonds Mfg. Co., Pittsburgh, Pa.

"Try Simonds Service"

For Fifteen Years This Mark AD on GEARS

—has stood for quality, accuracy, dependability, and service in supplying

CUT GEARS of All Kinds

Spur, Bevel, Helical, Worm, Internal, Bakelite, and Rawhide Pinions.

We also make Spur and Worm Gear

SPEED-REDUCING UNITS

Albaugh-Dover Mfg. Co.
2151 Marshall Blvd., Chicago, Ill.

Member American Gear Manufacturers' Association

GEARS

As You Want Them
When You Want Them
Worm Gear Speed Reducers

THE HORSBURGH & SCOTT CO.
"Gear Makers Since '89" CLEVELAND, U.S.A.

Ready to accept orders for immediate attention

DIEFENDORF GEAR CORPORATION

SYRACUSE, N. Y.

Cleveland
WORM GEAR REDUCTION UNITS

CLEVELAND WORM & GEAR CO.
America's Worm Gear Pioneers 3254 East 80th St., Cleveland, Ohio

GEARS *Cut to Your Specifications*

Spur Gears—Helical Gears
Worm Wheels—Worms
Screws—Racks

The Adams Co. 1900 Bridge St., Dubuque, Iowa

EARLE

Cut Gears For Any Purpose
Bridge Operating Machinery
Special Machinery
"Lea-Simplex" Cold Metal Saws

THE EARLE GEAR AND MACHINE CO.
PHILADELPHIA, PENNSYLVANIA

We fill your needs every day

Whatever your particular gear requirements, it is safe to say we ship every day, orders covering similar requirements. Specialists in excellent gear design and correct manufacture, we offer our services to you for gears in any size, form or quantity.

Drop us a line—we'll send you Catalog D

Fabroil Gears—Steel Gears—Cast Iron—Rawhide—Any Size—Any Type

The Cincinnati Gear Co.

1825-27-29-31-33 Reading Road, Cincinnati, Ohio

GEAR GENERATORS

Straight Tooth or Spiraloid Bevel Gears

Up to 32-in. O.D. cut Theoretically correct. SPECIAL facilities for CUTTING, in any MATERIAL. SPUR, MITRE, WORM, HELICAL, INTERNAL, ELLIPTICAL GEAR WHEELS, SKEW (Hypoid) BEVEL GEARS.

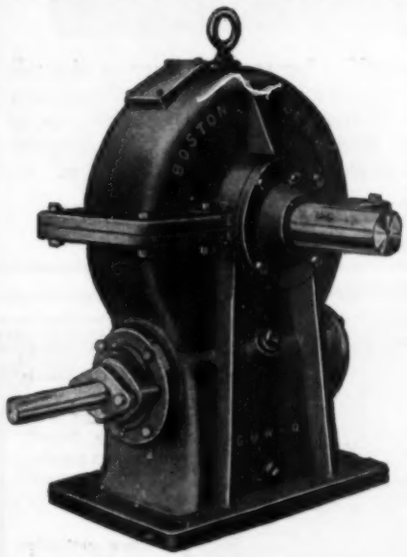
Let the *originators* of *Spiraloid* and *Skew (Hypoid)* GEARS with offset AXES solve your GEAR PROBLEMS

THE BILGRAM MACHINE WORKS

1235 Spring Garden St., PHILADELPHIA, PA.

Manufacturers of GEARS and GEAR CUTTING MACHINES

Reduce Your Maintenance Costs!



Speed Reducers in stock for Immediate Delivery do this for you.

Get new booklet— "Modern Speed Reduction"

BOSTON GEARS

BOSTON GEAR WORKS SALES CO.

Norfolk Downs, Mass.

Boston New York Philadelphia Cleveland Chicago

30 years experience

A seasoned organization that builds the kind of gear you may always depend upon.

FOOTE BROS. GEAR & MACHINE CO.

215 N. Curtis St., Chicago

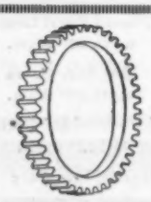
HERRINGBONE CUT GEARS

MILL DRIVES — SPEED REDUCERS

FAWCUS

SPUR WORM BEVEL GEARS

FAWCUS MACHINE CO. PITTSBURGH, PA.



"PENMAID"

GEARS

REDUCTION UNITS

Spur, Bevel, Worm, Spiral, Mitre

Pennsylvania Gear & Machine Co., Inc.

2239-49 E. Tioga St., Philadelphia, Pa.

→ Meisel MP Gears ←

GEARS

GEARS

GEARS

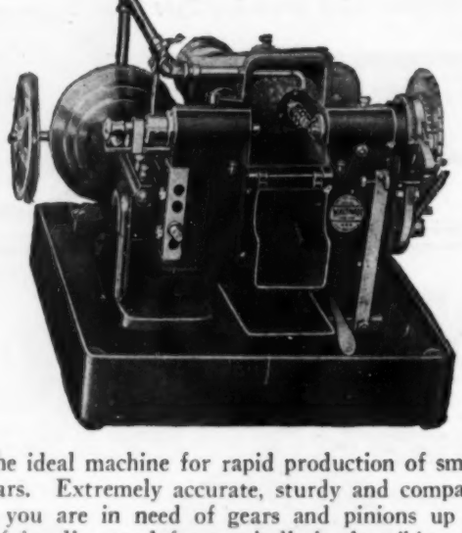
GEARS

Meisel Press Mfg. Co.

946 Dorchester Ave., Boston, Mass.

WALTHAM
TRADE MARK
REGISTERED U.S. PAT. OFF.

Automatic Pinion and Gear-Cutting Machine



The ideal machine for rapid production of small gears. Extremely accurate, sturdy and compact. If you are in need of gears and pinions up to 1½ in. dia., send for our bulletin describing the Waltham. It is free and mighty instructive.

WALTHAM MACHINE WORKS
High Street, WALTHAM, MASS.

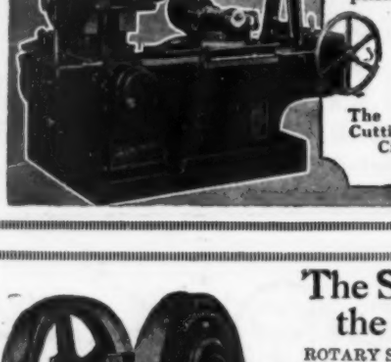
Gear Grinders *Gear Testers*

THE LEES-BRADNER CO.
Cleveland, Ohio

Thread Millers *Gear Generators*

Schuchardt & Schutte
Gear Hobbing Machines
made in eight different sizes for *spur, worm* and *spiral* gears from the smallest watch pinion to large diameter turbine gears.
Accuracy Workmanship
Ease of Operation
Large Production
are outstanding features. *Great value for your initial investment, great profits thereafter.*
SCHUCHARDT & SCHUTTE OF NEW YORK
GEORGE SCHERR,
142 Liberty Street
New York, N. Y.

CINCINNATI GEAR HOBBERS



Our claims for this machine are based on production results already accomplished.

Time estimates for your work on request.

The Cincinnati Gear Cutting Machine Co.
Cincinnati, Ohio

B~C
Hobbing Machines
Hob Sharpening Machines

BARBER~COLMAN COMPANY
Rockford, Ill., U.S.A.

The Skill is All in the Machine

ROTARY SWAGING is the modern and economical method of forming solid or tubular circular metal sections without waste of stock. The Langelier Swaging Machine reduces or tapers to a circular section, square, round, hexagonal or similar shapes, hot or cold. We build special swaging equipment for Tungsten Filament Wire.

Our policy is to equip the machine in every detail with work holding and feeding devices that will enable them to give the most efficient service with unskilled help at a low upkeep cost.

Machines built to date have capacity ranging from a pin point to 2½ in. diameter on solid stock and to 6 in. on tubing.

LMCo.
LANGELIER MFG. COMPANY
Arlington, Cranston, R. I., U. S. A.

Newark Gear Cutting Machine Co.

Henry E. Eberhardt, Pres.
Gear Specialists
69 Prospect Street, Newark, N. J.
Manufacturers of Automatic Gear Cutting and Gear Hobbing Machinery

---

GEARS for MOTOR MACHINE MILL or POWER PLANT

ENGINEERS FOUNDERS MACHINISTS MILLWRIGHTS
THE A. & F. BROWN CO.
79 BARCLAY ST. NEW YORK

Planed Bevel Gears up to 48" diam.
Cut Spur Gears up to 96" diam.
Machine Moulded Gears up to 192" diam.

Steel, Sem Steel, Cast Iron, Bronze, Bakelite, Condensite, Fibre, etc

Thrust load capacity up to 50% of radial load capacity

NOMINAL COST PLUS BETTER SERVICE

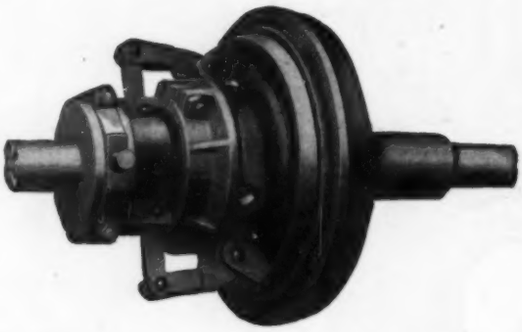
THE outstanding features of "COMMERCIAL" Annular Ball Bearings are low cost and high efficiency. That is why the demand for these bearings increases and expands year by year. They are adaptable to hundreds of different products and various types of duty. Accurately built and carefully finished. Use "COMMERCIALS" in your product or plant.

Commercial
ANNULAR BALL BEARINGS

A Typical Installation

Sign flashers usually consist of a main shaft on which there are spring copper segments forming parts of switches, this main shaft being connected by worm and worm gear to a shaft direct connected to an electric motor. "Commercial" Annular Ball Bearings are used on both the main shaft and the worm shaft. On main shaft, Type A bearing No. 1110. On worm shaft, Type A bearing 2080.

THE SCHATZ MANUFACTURING CO., Poughkeepsie, N. Y.



The "Lemley" Friction Clutch

Send for Catalog No. 30

W. A. Jones Foundry & Machine Company
4404 West Roosevelt Road, Chicago, Ill.

Pacific Coast Representatives: The King-Knight Company
San Francisco Los Angeles Seattle

Branch Sales and Engineering Offices:
New York Pittsburgh Milwaukee Cleveland Buffalo Detroit

Jones

Power Transmitting Machinery

FORD TRIBLOC

Only a few minutes
—but it takes the men from their jobs

Whenever lifting and hauling of loads is done in your shop by machine operators, it means that you pay for not only the time of the men but the idle time of machines, too.

Let brawn of steel do the lifting for these machine operators. Let them use all of their time for the profitable job of keeping the machines producing.

Let us tell you how you can use Triblocs and why it will pay you to install them. Ask for Catalog 7-B.

FORD CHAIN BLOCK CO.,
Second & Diamond Sts.
Philadelphia, Pa.

We also manufacture "THE MOTORBLOC"
—an electrically driven chain hoist.

Everedy Electric Hoist

Speed in Hoisting

The Everedy Electric Hoist will make quick work of anything within its weight limitations which vary according to the models.

Mechanically correct, built of the best materials by highly skilled workmen they have demonstrated their effectiveness and long service.

Reading Chain & Block Corp.
Cranes—Electric Hoists—Chain Blocks
Reading, Pa.
90 West St., New York

The easiest way and quickest way

to remove gears, couplings, cams, collars, flywheels, etc., from a shaft, is with a Crane New Model Patented Puller. It grips the part and removes it without damaging it or burring or upsetting the end of the shaft. Saves time and labor. Guaranteed to satisfy.

Write for descriptive circular

Crane Puller Co., South Deerfield, Mass.

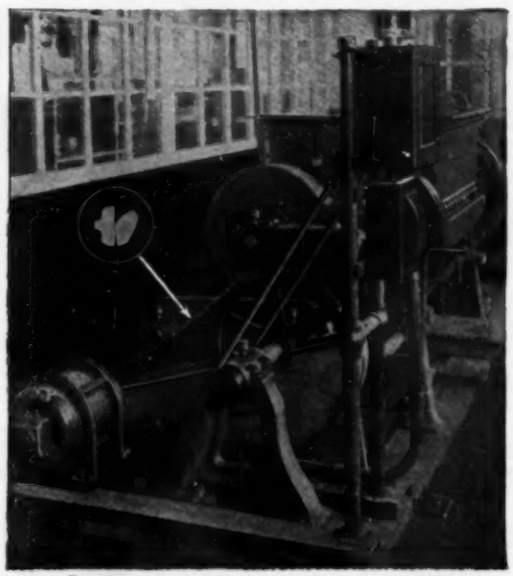
FOX

Multiple Spindle Drilling
and
Automatic Tapping Machines
Also
Fox Superflex Power Presses

Send for Fox production estimate

FOX MACHINE CO., Jackson, Mich.

The largest clock in the world atop the Colgate plant overlooking New York Harbor. It is 50 ft. in diameter; the hands and movement alone weigh 4 tons.



Five Hp. Morse Silent Chain Drive from motor to Day Imperial Soap Mixer, Colgate & Co., Jersey City, N. J. Driver, 825 r.p.m.; Driven, 160 r.p.m.

COLGATE

ESTABLISHED 1806

relies on

MORSE CHAINS

This world renowned name stands for quality in toilet soaps, shaving soaps, dentifrices, toilet waters, perfumes, compacts, face creams, talc powders and hair preparations. But back of all this wide popularity of Colgate's products must be sound manufacturing principles and dependable plant equipment.

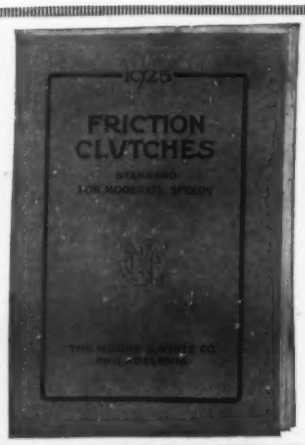
Day in and day out, soap mixers, conveyors, compressors and other machines in the Colgate plant are depending on Morse Silent Chain Drives for perfect action. Their reliability and efficiency in transmitting power and reducing speeds play an important part in the production of Colgate products. They are positive, flexible, durable.

Over 5,000,000 H.P. in use, one tenth to 5,000 H.P., 6,000 r.p.m. to 250 r.p.m. and slower, especially effective on short centers.

MORSE CHAIN CO., ITHACA, N. Y., U. S. A.

Morse Engineers are always available at:

ATLANTA, GA.....702 Candler Bldg. Earl F. Scott & Co.
BALTIMORE, MD.....1402 Lexington Bldg.
BIRMINGHAM, ALA.....Moore-Handley Hdwe. Co.
BOSTON, MASS.....141 Milk St.
BUFFALO, N. Y.....Ellicott Square Building
CHARLOTTE, N. C.....404 Commercial Bank Bldg.
CHICAGO, ILL.....112 W. Adams St.
CLEVELAND, OHIO.....421 Engineers Bldg.
DENVER, COLO.....211 Ideal Bldg.
DETROIT, MICH.....7601 Central Ave.
LOUISVILLE, KY.....516 W. Main St. E. D. Morton Co.
MINNEAPOLIS, MINN.....413 Third St. Strong-Scott Mfg. Co.
NEW ORLEANS, LA. Queen & Crescent Bldg., 334 Camp St. A. M. Lockett & Co., Ltd.
NEW YORK, N. Y.....50 Church St.
OMAHA, NEB.....727 W. O. W. Bldg. D. H. Braymer Equipt. Co.
PHILADELPHIA, PA.....803 Peoples' Bank Bldg.
PITTSBURGH, PA.....Westinghouse Bldg.
SAN FRANCISCO, CALIF.....Monadnock Bldg.
ST. LOUIS, MO.....2137 Railway Exchange Bldg.
TORONTO, 2, ONT., CAN.....50 Front Street E. Strong-Scott Mfg. Co.
WINNIPEG, MAN., CAN.....Dufferin St. Strong-Scott Mfg. Co.



Moore & White Friction Clutches

40 Years on the Market
Over 200,000 in Operation

Send for Catalog E

THE MOORE & WHITE CO.
2701 to 2731 N. 15th Street
Philadelphia, U. S. A.

for all types of industrial machinery

The applications of Raybestos run the gamut of Industrial machinery. It serves as a frictional slip clutch on fractional horsepower motors and effectively brakes 50-ton cranes. The essence of more than 20 years' experience is at the call of any manufacturer. Ask us to recommend the right size and type. Catalog upon request.

Silver Edge Raybestos

THE RAYBESTOS COMPANY
Bridgeport, Conn.

The Canadian Raybestos Co., Ltd.
Peterborough, Ont., Canada
Branches: New York, 299 Broadway; Detroit, 2631 Woodward Ave.; San Francisco, 439 Bryant St.; Chicago, 1603 South Michigan Ave.

HALLOWELL
Rigid Steel Bench Legs

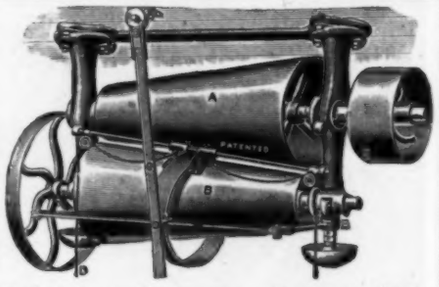
make it easier and cheaper to build stronger and neater work—assembly—and storage—benches and tables.

Get our money-saving, bench leg data. Tells how good benches save money and increase production—why wobbly, rickety benches spoil work and decrease profits. Write today.

Note the wide flaring feet for substantial support.

Standard PRESSED STEEL Co.
The Pioneer Steel Hanger People
Box 4, Jenkintown, Pa.

Any Speed 1 to 6



From 1 to 6, you can obtain just the speed the machine requires with the Evans Variable Speed Countershaft. All you do to change the speed is pull the cord while the machine is running, if you wish.
This device is guaranteed to give service for years. It acts as a clutch well as a speed changing device.

If you want details, write for Catalog 25.

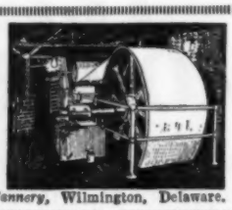
Evans Friction Cone Co., Newton Centre, Mass.
A. Warden & Co., 48 Shepherdess Walk, City Road, London, E. C., England.

Belt User's Book Free

Users find it helps them to get the most from their belts. Lots of men ask for it because it gives them the practical side of belt usage with little of the technical. Mailed gratis.

J. E. RHOADS & SONS

Philadelphia, 33 N. Third St.
New York, 100 Beekman St.
Chicago, 320 W. Randolph St.
Atlanta, 71 S. Forsyth St.
Cleveland, 1202 W. Ninth St. *Factory and Tannery,* Wilmington, Delaware.



DRILL JIG BUSHINGS

Specializing in this product, Ex-Cell-O offers lowest prices, prompt shipments. Send for cost-cutting data sheets.

Makers of XLO Grinding Spindles

EX-CELL-O TOOL & MFG. CO.
1467 East Grand Boulevard - - DETROIT

Haskins Flexible Shaft Equipment
are needed in every line of industry. Let us go over your production problems with you. It will pay.

Catalog on Request.

R. G. HASKINS CO., 3446 West Lake St.
Chicago, Ill.

CULLMAN SPROCKETS

Let us quote you on your *Sprocket* requirements
In stock and to order.
Send for Catalogue.

CULLMAN WHEEL COMPANY
1349 Altgeld St., CHICAGO, ILL.

BRISTO SAFETY SET SCREWS

Extra-small sizes our specialty—all sizes from 1½ in. to 3/16 in.—*some smaller.* Bulletin B-814 tells why the dovetailed flute design is better. Write
THE BRISTOL COMPANY, Waterbury, Conn.

K-L KANTI-LEVER
SPRING COUPLINGS
Correct parallel and angular misalignment

Brown Engineering Co.
115 N. THIRD ST., READING, PA.

"American Pulleys and Hangers"
will keep your plant running smoothly. Write for descriptive literature, list of dealers, and catalog.
THE AMERICAN PULLEY COMPANY,
4200 Wissahickon Ave., Philadelphia, Pa.

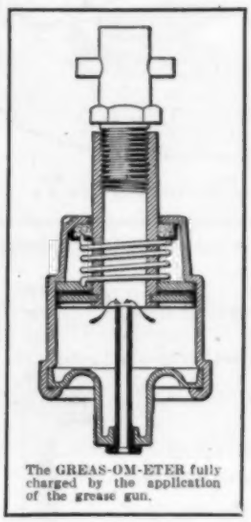
AMERICAN
PRESSED STEEL HANGERS | STEEL SPLIT PULLEYS
PATENTED PATENTED

I-O-HED PATENTED

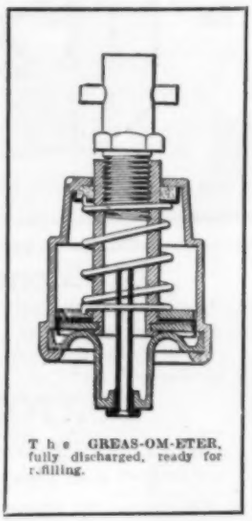
Capacities 1000 to 24,000 lbs.
5 Types
For A.C. or D.C.

"The Electric Hoist that operates in the Minimum Headroom"
American Engineering Co., 2421 Aramingo Ave., Philadelphia, Pa.

Cool Running Bearings
with a reduced grease consumption



The GREAS-OM-ETER fully charged by the application of the grease gun.



The GREAS-OM-ETER, fully discharged, ready for refilling.

The **GREAS-OM-ETER**

makes this possible by feeding just enough grease to keep the bearings perfectly lubricated—and no more. Under a steady low pressure all the old broken down grease is forced out and replaced with new lubricant. The bearing surfaces are always flushed clean.

Simple and positive in operation. The Greas-om-eter feeds the grease thru a metering tube. The rate of feed is regulated by inserting different sizes of metering pins. Once the required size of pin is in place no further attention is necessary.

Adapted to any standard pressure lubricating system in which ball check supplies are provided.

The extension of the stem is an unfailing "tell-tale" that indicates when replenishment of the grease is required.

Write for further details.

The Greas-om-eter Corporation
460 Montgomery St., San Francisco, Cal.

STANDARDIZED PARTS FOR DIES, JIGS AND FIXTURES

A complete line of Standardized *Drill Bushings, Leader Pins, Dowel Pins* and *Expansion Laps.* Send for our data and Price charts.

ACME INDUSTRIAL CO.
417 N. CARPENTER ST., CHICAGO, ILL.

PIPE THREADING AND CUTTING MACHINERY

Belt or motor driven range ⅛ in. to 18 in. inclusive, also portable machines ⅛ in. to 6 in. inclusive.

D. Saunders Sons, Inc., Yonkers, N. Y.

Catalogue on request

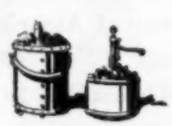
DRILL
VISES
Drill
SPEEDERS
KNURL HOLDERS
For Turrets

The Graham Mfg. Co.
Providence, R. I.
Great Britain—Stockton & Bunn, Ltd.
France, Italy, Switzerland, Spain and Holland—
Fenwick Freres & Co.

Furnished in either bottom drop or umbrella type. Bucket may be removed and an electro magnet used when that method of charging is desired. Write for Bulletins.

SHEPARD ELECTRIC CRANE & HOIST CO.,
352 Schuyler Ave., Montour Falls, N. Y.

SHEPARD
ELECTRIC CRANES & HOISTS



Charging Buckets

Why not use the best? **The DROPFO VISE**

The DropFo Vise gives you service, long life and our swivel methods and patented swivel base construction, so constructed that by tightening up the main screw you tighten the swivel on the base. This vise is now in service in the largest manufacturing concerns in the United States. When in need of a vise give us an opportunity to prove the merits of the vise to you.

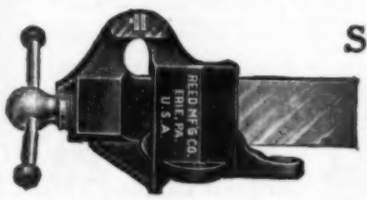
Introductory Prices now effective for a limited time only:

Size	Jaw Opening, In.	Weight Lbs	Introductory Prices Swivel	Prices Stat'y
3-inch	5½	23	$8 50	$7 50
4-inch	6	35½	10 00	9 00
4½ inch	7	45	15 00	13 00
5 inch	8	52½	18 00	16 00

Kindly mail your order direct. We guarantee the product

THE FULTON DROP FORGE CO., Canal Fulton, Ohio

REED VISES

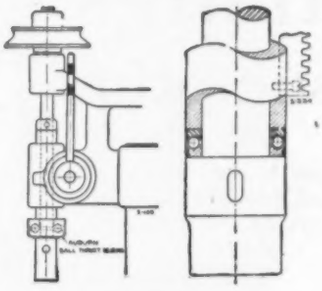


Strongest and Last Longest

For more than twenty years Reed Vises have been the most carefully made vises obtainable. *Send for booklet.*

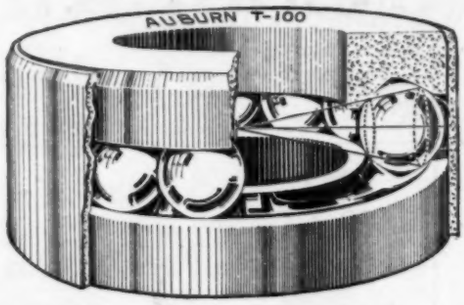
Reed Manufacturing Co., Erie, Pa.

PRODUCTION SCHEDULES *maintained with* AUBURN THRUSTS



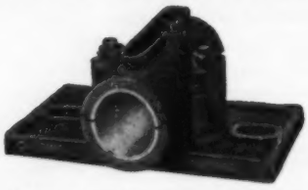
Drill Presses and all Machinery stand up under heavy Production Schedules when equipped with Auburn Bearings. Mail particulars of your problem and get the Auburn Answer.

Steel, Brass and Bronze Balls



AUBURN BALL BEARING CO. **Established 1893** 25 Elizabeth St., Rochester, N. Y.

Caldwell Bearings



CAST from aluminum patterns—not wood, Caldwell Bearings are smooth and accurate—not undersize—not oversize. All bases are ground—true, smooth and parallel with the center line of the bearing.

All bearings are either bored or broached to size. —And both ends of our bearings are machine-finished.

If you need elevating, conveying or transmission machinery, address Caldwell, or nearest Link-Belt Company office.

Caldwell Products

Bearings, Shafting, Pulleys, Hangers, Car Spotters, Chains, Wheels, Buckets, Helicoid Conveyors and Accessories, Belt Conveyors, Chain Conveyors, Elevator Buckets, Boots and Casings, Etc.

H. W. CALDWELL & SON CO.
LINK-BELT COMPANY, OWNER C-56
CHICAGO, 1700 S. Western Ave.
Dallas, Texas 810 Main St.
New York Woolworth Bldg.

Big Money

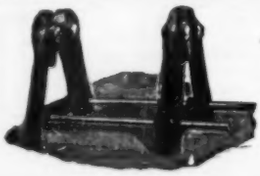
There's good profit in small engraved work, such as dies, radio parts and the like providing you are equipped to produce them rapidly and accurately. The

GORTON Engraving Machine

has paid for itself many times over on such work in scores of shops.
It is easily handled and possesses the "fool proof" features that keep it long in service. Tell us something about your work.
We make this machine in different sizes and styles, suited to a vast variety of work.

Send for our catalog.

GEO. GORTON MACHINE COMPANY
RACINE, WISCONSIN



ANDERSON IMPROVED
BALANCING WAY
Made in various sizes for balancing Pulleys, Gin Brushes, Turbine Rotors, Crankshafts, Polishing Wheels, Flywheels, etc.

Anderson Bros. Mfg. Co.
1917 Kishwaukee St.,
Rockford, Ill., U. S. A.

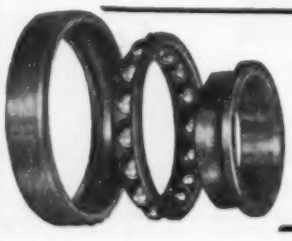
Strom BALL BEARINGS

Years of additional service are now assured by the use of
Molybdenum Steel Balls

STROM BALL BEARING MFG. CO.
4530 Palmer St., CHICAGO

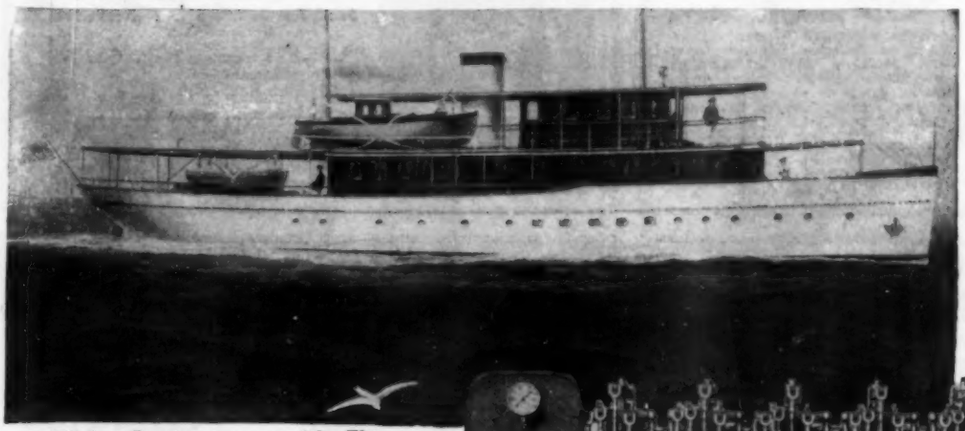
BURNISHING BALLS
CONES AND PINS
Specialists in the making of all sizes of Burnishing Balls; Special Shapes, such as Cones, Pins, etc., and Caster Balls. Send us prints or specifications and we will be glad to quote you.
Also makers of SPECIAL SHAPED RIVETS.
THE HARTFORD BALL & RIVET CO., Hartford, Conn.
P. O. Box 170.

THE MOST COMPLETE LINE OF BALL BEARINGS TYPES AND SIZES IN AMERICA
FAFNIR
TRANSMISSION EQUIPMENT
THE FAFNIR BEARING CO. NEW BRITAIN, CONN.

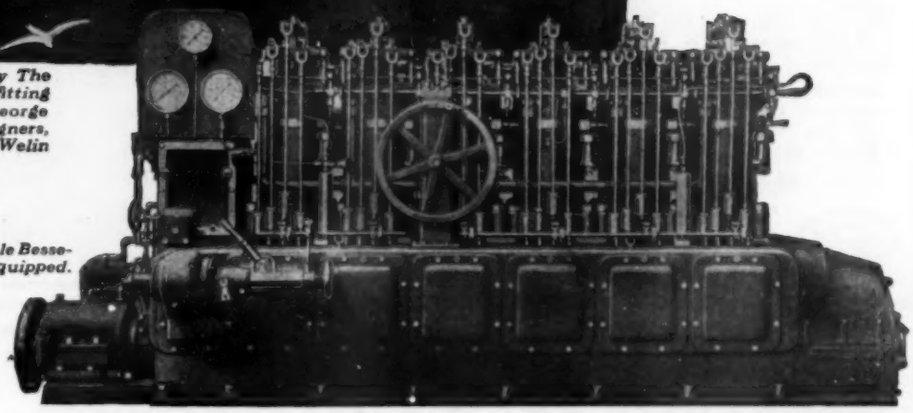


The Bearings Company of America, Lancaster, Penna.
Angular Contact Thrust Bearings Angular Contact Radial Bearings
Manufacturers of Thrust Ball Bearings of all types
Let our Engineers help to solve your Bearing Problems
Detroit, Mich., Office, 1012 Ford Building

Now—Diesel Engines with Timken Bearings



Timken Bearings were used by The Bessemer Gas Engine Co. in fitting the "Alpha." Owner, Mr. George Marshall Allen, New York. Designers, Henry J. Gielow, Inc. Builders, Welin Davit & Boat Corporation.



A 125-150 h. p. direct reversible Bessemer Diesel Engine, Timken-equipped.

No responsibility is too great for Timken Tapered Roller Bearings. Latest proof is the use of Timkens in Diesel engines, by The Bessemer Gas Engine Co., one of the great producers of internal combustion engines.

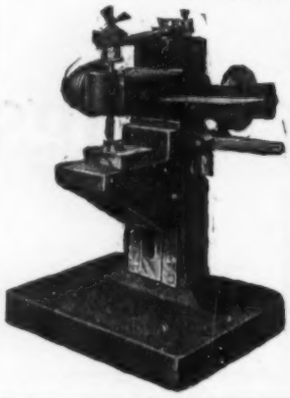
Only the most exhaustive comparative experiments by Bessemer certified Timkens for numerous Diesel mountings, including the marine propeller thrust position of a costly private yacht.

Speeding this 100-ft. vessel, of 250 h. p., at 12 knots or more, the Timken Bearings must and do perform infallibly. With their easy-rolling properties, tapered design, Timken-made steel, and *POSITIVELY ALIGNED ROLLS* Timkens bring power economy, smoothness, freedom from attention, and permanent precision.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN
Tapered
ROLLER BEARINGS

Just the thing for small riveting



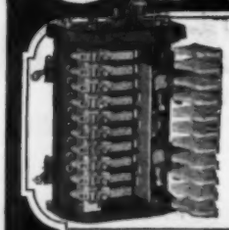
This rotating vibratory riveter is a light bench model that will speed up your production on small riveting up to ⅜ in. diameter. Easily operated by an apprentice or the most inexperienced female labor.

GRANT Riveters

are manufactured in many styles. There are Noiseless Spinning Riveters, Multiple Spindle Riveters, Pneumatic Riveters, and many other designs. Complete details are outlined in "Perfect Riveting." Send for your copy today.

The Grant Mfg. & Machine Co.
85 Silliman Avenue
Bridgeport, Conn.

UNION



Specially designed for
Squirrel cage, Multi-speed, Slip Ring and all D.C. Motors.
Send for bulletins and detailed information.

Union Electric Mfg. Co.
Milwaukee, Wisc.
20 Sales and Service Offices.

CONTROLLERS

HYDRAULIC VALVES AND FITTINGS

Watson-Stillman valves are designed to perform their functions with ease and safety. The materials are the best obtainable, and each valve or fitting is tested to a safe overload.

Our line embraces an almost endless number of combinations designed to meet the varied requirements of hydraulic systems.

Write for Catalogs

The Watson-Stillman Co.
72 West Street, NEW YORK
Cleveland, Detroit, Chicago
St. Louis Philadelphia

"Buffalo" Electric Blowers

for all Services—

We have a blower for every kind of service—blowing, exhausting, conveying, cooling, ventilating, mechanical draft.

Get our catalog 860.

BUFFALO FORGE CO.
448 Broadway, Buffalo, N. Y.

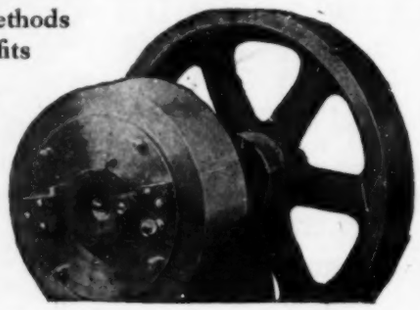
In Canada—Canadian Blower & Forge Co. Ltd., Kitchener, Ont.

American Sand Blast
"WITH A REPUTATION FOR SIMPLICITY"

Dependable

The American Foundry Equipment Co.
406 BYRKIT AVE. MISHAWAKA, IND.

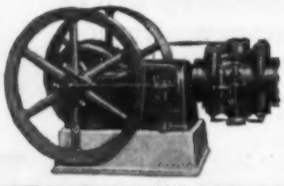
Improved Methods Increase Profits



Are you taking advantage of modern machining methods? Swaging the Dayton way makes metal solid, tough and elastic. Daytons deliver from 2,000 to 6,000 blows per minute.

The details will convince you—get them.

THE TORRINGTON CO., 56 Field St., Torrington, Conn.
Excelsior Plant—Successor to Excelsior Needle Company
Coventry Swaging Co., Ltd., White Friars Lane, Coventry, England. Agents for Great Britain, Fenwick Freres & Co., 8 Rue de Rocroy, Paris, France, Italy, Belgium, Spain, Portugal and Switzerland.



Cheap Air Power for the Shop
?
SULLIVAN COMPRESSORS
Supply It.
SULLIVAN MACHINERY CO.
429 Gas Bldg., CHICAGO

OHIO *reliable* MOTORS
1/20 to 1/3 H.P.
The Ohio Electric & Controller Co. *Cleveland, O.*

ETNA Swaging Machines

will handle the most difficult work, built to take from ¼ in. up to 4½ in. capacity.

Tube Making Machinery **Gray Iron Castings**
Cutting Off Machines
Send for complete data

THE ETNA MACHINE CO., TOLEDO, O.

CELFOR

LEXICOGRAPHY

Cel'for (from Latin *"celeritas"*—speed, and *"fortis"*—strength) a trade marked name for High Speed Twist Drills and Precision Tools of merit.
—the standard of the machine world by which all drills are judged.

Write for Catalog No. 19

CLARK EQUIPMENT CO.
BUCHANAN, MICH.

Proof!

There's only one real test of quality in a motor—the *service* it gives. That MASTER MOTORS meet this test is evidenced by the fact that an ever increasing number of prominent manufacturers and jobbers are adopting them and that our customers continue to use and recommend them. Write for complete details.

THE MASTER ELECTRIC CO.
Linden and Master Aves.
Dayton, Ohio

STOCKS CARRIED IN PRINCIPAL CITIES

MASTER GUARANTEED MOTORS

⅛ TO 7½ H.P. Dayton THE MASTER ELECTRIC CO. Ohio Less than 40°

TIREX NEVER KINKS

As long wearing as an automobile shoe

The tough, sixty per cent rubber armor which protects TIREX Portable Cord from injury will retain its flexibility and wear-resisitng qualities indefinitely.

In actual service it has proven to be almost wear-proof and extremely economical.

TIREX all rubber Portable CORD

The more severe the conditions under which your portable tools perform, the greater your need for TIREX and the better the chance for TIREX to prove that it can stand rough treatment.

SIMPLEX WIRE & CABLE CO.
Manufacturers
201 Devonshire St., Boston 9
Chicago San Francisco New York

H&H SNAP SWITCHES

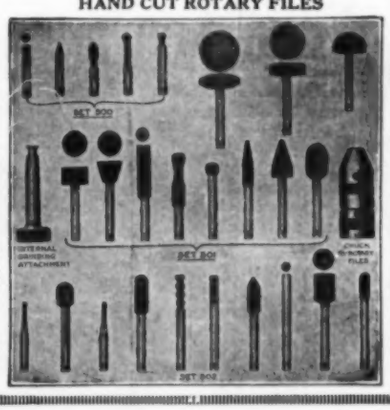
To Control your Machines Heating and Lighting Units

And for electrically operated Portable Tools, Washing and Ironing Machines; Vacuum Cleaners, Sewing Machines, Textile and Shoe Machinery from fractional horsepower to 2 or 3 horsepower; Panelboards, Appliances etc.

Ask for catalogue or quotations

THE HART & HEGEMAN MFG. CO. HARTFORD CONN.

HIGH SPEED HAND CUT ROTARY FILES



Strand
Rotary Files

Used with Strand Flexible Shaft Machines. Are giving excellent service.

Write for Catalog

N. A. Strand & Co.
5001 No. Lincoln St.
Chicago

"CLARK" Tools Win by Comparison

CLARK AUTOMATIC DRILL

Switch "Handy to the Hand." Full line of electrically driven drills and grinders.

Send for Catalog

Jas. Clark, Jr., Electric Co., Incorporated
Louisville, Ky.

We specialize in motors, ⅛ to 150 hp. constant and adjustable speed D.C.; squirrel cage and slip ring A.C.

RELIANCE MOTORS

Reliance Electric & Engineering Co., 1044 Ivanhoe Rd., Cleveland, O.

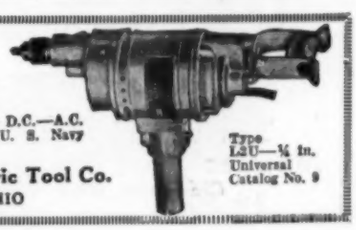
BURKE ELECTRIC CO.
ERIE, PA.

A.C. D.C. MOTORS A.C. D.C. GENERATORS
MOTOR GENERATORS, ARC WELDING EQUIPMENT

Sales Offices: Buffalo, Cleveland, Detroit, Erie, New York, Philadelphia, Pittsburgh, Chicago

Sales Agencies: Underwood Electric Co., Cincinnati; W. T. Osborn, Kansas City; J. E. Arnold, Tulsa, Okla.; The Berthold Electric & Engineering Co., Akron, O.

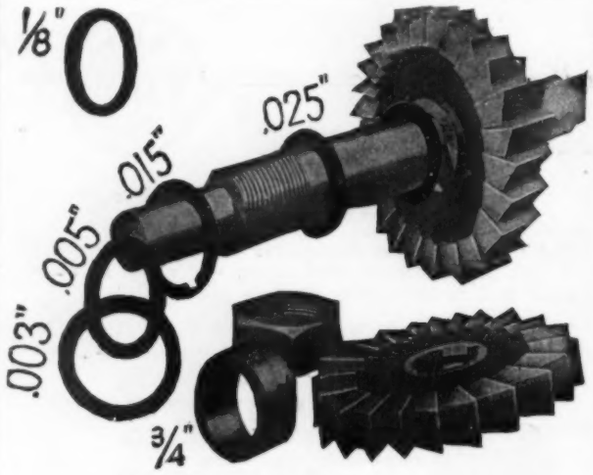
Portable Electric Drills and Grinders



Complete line of sizes suitable for D.C.—A.C. and Universal current tested to U. S. Navy requirements.

Type L3U—¾ in. Universal Catalog No. 9

The Neil & Smith Electric Tool Co.
CINCINNATI, OHIO



Steel Spacing Washers

Send for free assortment in the sizes you use most. Stock sizes for arbors of the following diameters:

⅜, ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾, 1⅞, 2, 2¼, 2½, 3, 3½ and 4 inches and larger.

Stock Thicknesses: .001, .002, .003, .004, .005, .006, .007, .008, .010, .012, .015, .020, .025, .032, .047, .063, .093, and .125 inch.

Spacers thicker than ⅛ in. are turned from tubing but not carried in stock.

Prices and Samples on Request.

Detroit Stamping Company
3445-3459 West Fort Street, Detroit, Mich.

How do you cut scrolls, cam paths, spirals, irregular shaped contours, etc?

This

Vertical Mill

with special equipment is used for many odd jobs. Perhaps it is just what you need.

If we receive your blueprint or sample we can tell you promptly if we can equip profitably for your requirements.

THE TAYLOR & FENN COMPANY
HARTFORD, CONN., U. S. A.

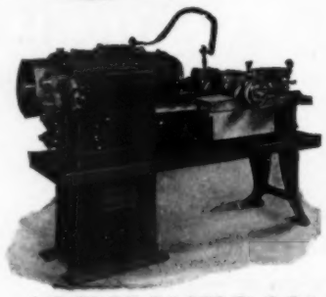
Cam Milling Machines

with the Rowbottom name upon them, are your way to cams that require no touching up by hand. Send for a catalog today.

If your cam requirements do not warrant the purchase of one, you practically own a Rowbottom Universal Cam Milling Machine when you give our contract department the order to make your cams.

The Rowbottom Machine Co.
Waterbury, Conn.

The "Automatic" Chasing Machine



Cuts any style thread —single—double—material — up to 14-inch diameter. Full automatic operation assures speed and accuracy. No time out to grind tools.

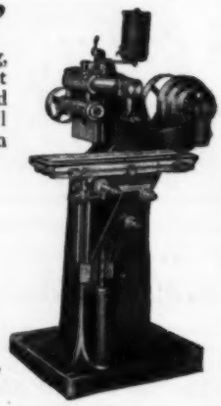
Send for Catalog TM

AUTOMATIC MACHINE CO.
115 E. Washington Avenue, Bridgeport, Conn.

Here's a good "don't"

Don't make the mistake of using big, expensive milling machines on light jobs, where the U. S. Improved Hand and Weight Feed Milling Machine will give you greater and better production at infinitely lower cost.

Don't! It isn't logical. Bulletins on request.



The U. S. IMPROVED
Hand and Weight Feed
MILLING MACHINE

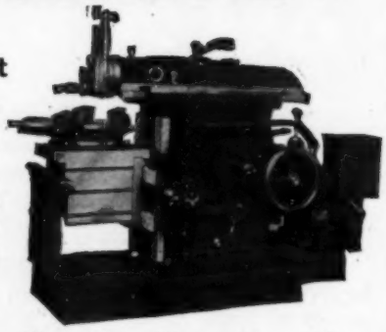
The United States Machine Tool Company
Cincinnati, Ohio

STOCKBRIDGE

Shapers save time and effort

A special crank motion reduces return time 20 to 30 per cent. Every adjustment is within easy reach on the working side. Selective gear shift and clutch are of automobile type. Made in 16-in., 20-in., 24-in., 26-in., and 32-in. sizes.

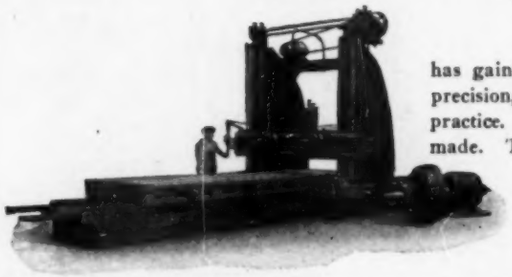
Write now for particulars.



Stockbridge Machine Co., Worcester, Mass.

William Sellers & Company Incorporated
Philadelphia, Pa.

Labor-Saving Machine Tools

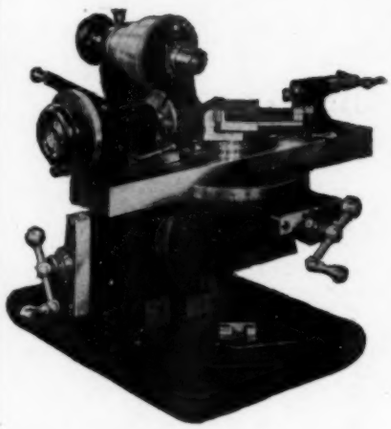


THE SELLERS PLANER

has gained an enviable reputation for accuracy, output and durability on precision, production and general work. Meets all demands of modern practice. Has ample power and speed. All adjustments quickly and easily made. Table drive and crossrail construction distinctive Sellers features.

TOOL GRINDERS—SHAFTING—DRILL GRINDERS

The Sloan & Chace Bench Miller Has a Greater Range



It would be difficult indeed to find a job beyond the range of this machine. The table tilted vertically gives any angle desired. The swivel feature revolves the table to bring the work in line. Scale graduations on both movements make guess work unnecessary.

Complete information gladly sent on request.

SLOAN & CHACE, Inc.
351-365 Sixth Avenue
NEWARK, N. J.

High output plus wide range—

Too many high production machines lack the ability to handle a wide range of parts. *Not so with the Goss & De Leeuw Automatic Chucking Machines.*

By abandoning the usual complicated system of special cams, etc., and substituting simple gearing and positive lead screws, Facing, Boring, Threading, Reaming, Forming, etc., can be performed *in the time of the longest operations*, and within closer limits than is ordinarily possible on any machine of its type.

Send for illustrated booklet showing constructional features and production figures on characteristic parts.

The Goss & DE Leeuw Machine Co.
New Britain, Conn.

REPRESENTATIVES: Henry Prentiss & Company—New York State, Northern New Jersey, Erie, Pa., Connecticut, Massachusetts. Chicago Representative: John H. Glover, 2120 North Menard Avenue. Cleveland Representative: S. B. Martin, 10612 Clifton Boulevard. Michigan Representative: J. C. Austerberry, 684 East Congress St., Detroit. Swind Machinery Co., Widener Bldg., Phila., Pa.

Goss & DE Leeuw Automatic Chucking Machine

CLEVELAND OPEN SIDE PLANERS

The life of your Planer is a consideration in the assets as well as the production output of your plant. Over 1070 installations of CLEVELAND OPEN SIDE PLANERS to date, many of which are repeat orders, give testimony of this.

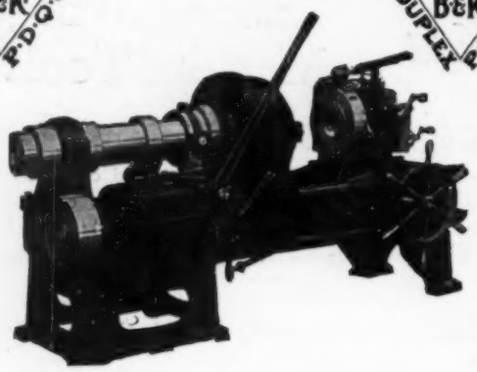
Send for descriptive circular.

Box Tables; all steel Gears; Improved Head Clamp; Power Rapid Traverse; Self Oiling Bushings throughout Drive; Counterbalanced Side Head; Single Turn Rail Clamp; Tool Box in Bed. Forced Feed Lubrication to Vees if desired.

26 in. to 72 in.

THE CLEVELAND PLANER COMPANY
Established 1900
3148 Superior Avenue, CLEVELAND, OHIO

PEERLESS B&K DUPLEX P·D·Q·C



Rapid and Accurate Pipe Threading

Is the kind done by B & K Pipe Threading Machines. They work with remarkable rapidity and ease of operation. Every thread is clean and accurate. Every machine is equipped with the Peerless Die Head. Made in nine sizes, each size having a capacity of 8 to 10 sizes of pipe.

Write for complete catalog

Bignall & Keeler Machine Works

Edwardsville, Ill.

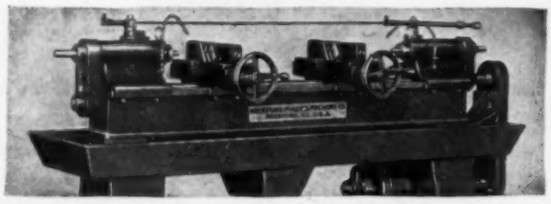
PEERLESS B&K DUPLEX P·D·Q·C

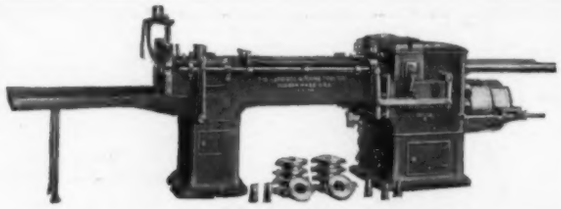
ROCKFORD

Double End Centering Machine

For centering both ends of a shaft simultaneously. Spindles operate together or independently. L. H. head is removable for long shafts. Accomodates a wide variety of work. Special fixtures furnished when desired. Send for Bulletin.

ROCKFORD MILLING MACHINE CO.
ROCKFORD, ILL.





Saves Money Three Ways

Saves money at the start because the LAPOINTE DUPLEX Broaching Machine is really equivalent to two machines, but costs little more than one. Saves money on floor space—saves money on direct labor operating charges.

And while you will like it because of its money-saving abilities, we would much rather stress its money-making talent.

Write for the Catalog.

LAPOINTE MACHINE TOOL CO., Hudson, Mass.

Branch Factory: The Lapointe Machine Tool Co., Ltd., Edgware, Middlesex, Eng.

VAN NORMAN
MACHINE TOOL CO.

SPRINGFIELD, MASS.

COOK'S WOOD-SCREW MACHINES

for making

Iron and Brass Wood-Screws

EASY TO OPERATE RAPID OUTPUT ALL SIZES

Modern plant equipment furnished for starting Wood-Screw factories

SEND FOR CATALOG 6-H

The Asa S. Cook Co., Hartford, Conn., U. S. A.

KELLY SHAPERS

Have the advantage of being the sole machine tool product of an organization of specialists. They possess correct design, unusual accuracy and are easy to operate. We make 14 in. Single Geared, 16 in., 20 in., 24-26 in. and 32 in. Back Geared Shapers. Write for a Catalog.

THE R. A. KELLY COMPANY Makers of shapers only for 25 years.
P. O. BOX 488 XENIA, OHIO, U. S. A.

SHAPERS

simply designed but accurate and efficient

12-in. to 32-in. stroke (inclusive)

THE SMITH & MILLS COMPANY
Cincinnati, Ohio, U. S. A.

KNIGHT MILLERS
MAKE PROFITS

See our ad in the first issue of this month

W. B. KNIGHT MACH. CO., ST. LOUIS, MO.

PLANETARY
THREAD MILLER

For milling the largest threads on a production basis.

The Hall Planetary Co.
Fox St. and Abbotsford Ave., Philadelphia, Pa., U.S.A.

Morton 36-Inch Draw Cut Shaper

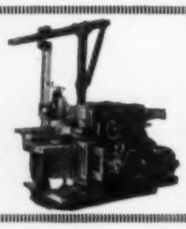
A somewhat wider range can be covered, and a heavier grade of work can be done on this machine than on our 30-in. stroke model.

The main difference lies in the fact that the cross-rail is adjusted by two screws instead of one. Also, it can be furnished with extended crossrail and larger table, which adapts the machine to work of a larger size.

We will gladly discuss the applicability of this machine to any work you may have.

Ask for Bulletin No. C-3.

Morton Mfg. Co., Muskegon Heights, Mich.



SHAPERS

The Ohio Machine Tool Co., Kenton, Ohio

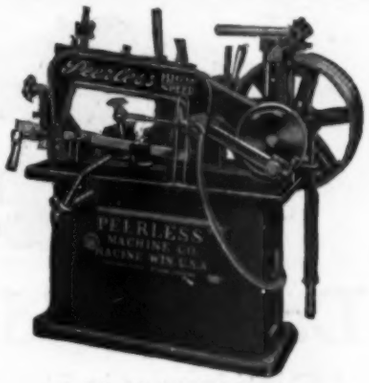
Since 1887

Only the best will give complete Satisfaction

The "Best" is PEERLESS,—and "Complete Satisfaction" means faster and more accurate cutting, Less Blade Wear, and a machine that will give Long Life. Get our literature for detailed description of the merits of these machines before deciding on your hack-saw equipment. Submit your problems,—our engineers are always at your service.

Peerless U. S. A. Power Blades are renowned for their cutting and lasting qualities. Our Duplex Hand Blades would be appreciated by your mechanics. Try out a dozen of each.

PEERLESS MACHINE COMPANY, 1615 Racine St., Racine, Wisconsin



Peerless HIGH SPEED

METAL SAWING MACHINES

Prolong Prosperity With Modern Machine Tools

6x6 in. High Speed Machine
Other capacities 9x9 in., 13x16 in.

CORRECT DESIGN SUPER QUALITY "LENOX" DROP FORGED WELL BALANCED

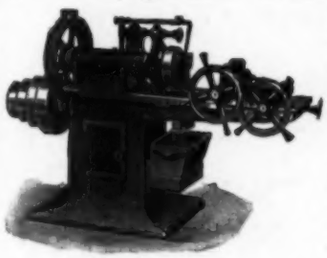
SCREW DRIVERS

"The Tools in the Plaid Box"

AMERICAN SAW & MFG. CO. SPRINGFIELD, MASS.

HACK SAWS - BAND SAWS - SCREW DRIVERS - GLASS CUTTERS

Strength and Weight



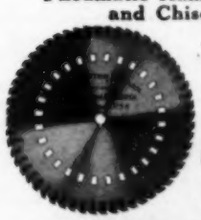
help to give Acme Bolt and Nut Machines their undoubted superiority as immediate cost reducers on all work in their capacity.

They turn out work faster than others and perfect accuracy can be depended upon. Write us for description of our entire line. Catalog?

THE ACME MACHINE COMPANY
CLEVELAND, OHIO, U. S. A.

SAWS FOR METAL CUTTING

Inserted Tooth; Solid Tooth; Milling; Hot Pneumatic Hammer Rivet Sets and Chisel Blanks



Hardened Steel Specialties

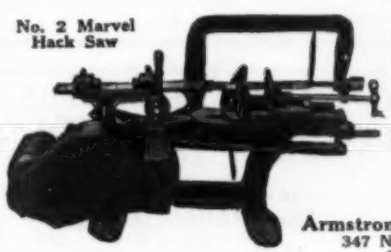
Send for our latest catalog.

HUNTER
Saw & Machine Co.
5652 Butler St.
Pittsburgh, Pa.

We furnish this saw complete with motor to run from any light socket, or with motor for stationary use. Also furnished belt driven. A good saw with good capacity.

Order now.

No. 2 Marvel Hack Saw



Send for our catalogue.

Armstrong-Blum Mfg. Co.
347 N. Francisco Ave.
Chicago, Ill.

Send Us Your Inquiries for

BOLT, NUT, FORGING AND WIRE NAIL MACHINERY

THE NATIONAL MACHINERY CO. TIFFIN, OHIO, U.S.A.

For screw machine economy, accuracy and big output

4 Sizes—Get Catalog

Cone Automatic Machine Co., Windsor, Vermont

Mr. J. C. Austerberry, 684 Congress St., Detroit, Mich.
Chicago Representative: John H. Glover, 2120 No. Menard Ave.
Ohio Representative: S. B. Martin, 10612 Clifton Blvd., Cleveland

CONE AUTOMATICS

COCHRANE-BLY CO.

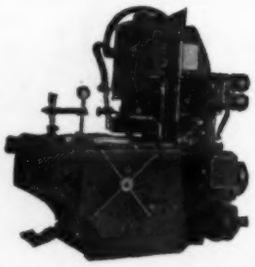
10-in. Compound Circular Table

A UNIVERSAL PROTRACTOR

With this device you can work from any number of centers at one setting of the work, such as required on Dies, Jigs, Templates, Cams, Etc.

Write for Circulars and Prices.

Cochrane-Bly Co.
Rochester, N. Y.
U. S. A.



Daily Dividends

THE investor in Blanchard Surface Grinders receives daily dividends in cost reduction. The adaptability of Blanchard Grinders to a variety of flat surface machining makes them unusually safe investments.

You can "Investigate before you invest;" send samples and blueprints today.

BLANCHARD

The Blanchard Machine Co.

64 State St., Cambridge, Mass.

For Severe Service

When tool steels and rails are to be cut, in fact when any tough job is at hand, "Milford" All Hard-Tungsten Steel Hack Saw Blades are best by proof. You might try them. A trial order always wins a steady user.

THE HENRY G. THOMPSON & SON CO.
Established 1876
New Haven, Connecticut, U. S. A.

THOMPSON'S HACK SAW BLADES

The Improved Thompson 10 x 36 Universal Grinding Machine

SELF-CONTAINED MOTOR DRIVEN

When restricted floor space or overhead interference demands the use of a self contained motor driven unit the new Thompson Grinding Machine answers the emergency. It will meet the famous countershaft type Thompson on even terms whether the work be cylindrical, surface edge, cutter, die or internal grinding. The headstock is independently driven. Send for the new catalog.

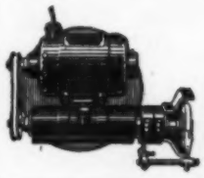
The Thompson Grinder Co.
Springfield, Ohio

FITCHBURG

Cylindrical Grinding Machine

Various sizes, both Power Feed and Hand Operated, for work up to 54 inches in length.

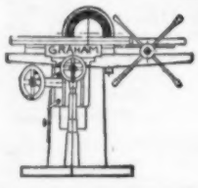
FITCHBURG GRINDING MACHINE CO.
FITCHBURG, MASS., U. S. A.



DUMORE

6 styles and sizes—with individual speed ranges—provide a grinder with the correct cutting speed for any grinding need. Dynamic balance eliminates vibration. Operates on AC or DC. Portable, no tearing down expensive set ups.

Wisconsin Electric Company, 27 Sixteenth Street, Racine, Wis.



GRAHAM GRINDERS

KNEE TYPE—RING WHEEL
for Flat Surfaces
NEW PULLEY GRINDER
GRINDER CHUCKS
for all machines, 10 to 30 in.

The GRAHAM MFG. CO.
Providence, R. I.
Stockton & Bunn, Ltd., London

BESLY CHICAGO

Besly Disc Grinders and Ring Wheel Grinders

The largest and most extensive line on the market.

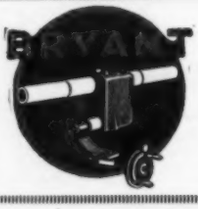
Write today for Besly Grinder Catalog.

CHARLES H. BESLY & COMPANY, CHICAGO, ILL., U. S. A.

INDUSTRIAL-DIAMONDS

WHEEL TRUEING TOOL CO.

DETROIT
New York-Chicago-Cleveland-Los Angeles-Walkerville Ont.



GRINDERS

Hole
Hole and Face
Deep Hole

Bryant Chucking Grinder Co.
Springfield, Vt.

BATH

Universal Grinding Machines

for Cylindrical, Surface, Internal, Disc, Tool and Cutter Grinding.

Built by
UNIVERSAL GRINDING MACHINE CO.
FITCHBURG, MASS., U. S. A.

ABRASIVE SURFACE GRINDER

Either Horizontal or Vertical Spindle Type

Countershaft or Motor Drive

Get our bulletin for particulars.

ABRASIVE MACHINE TOOL CO., East Providence, R. I.

Motor Driven Machine with Guards in Place

Grand Rapids Universal Cutter and Tool Grinders Embody—

SELF-CONTAINED MOTOR DRIVE. Grand Rapids Universal Grinders have been designed from the ground up as self-contained motor driven units. We are not offering an adaptation of a motor drive to a previously designed belt drive, and consequently are in a position to supply the best. A suitable power line motor in the base of the machine drives the grinding wheel spindle, the power feed mechanism, and the pump. A lamp socket motor built into the head stock revolves the work. Two spindle speeds, two work speeds, and four table speeds are provided.

BULLETIN ON REQUEST

GALLMEYER & LIVINGSTON COMPANY
346 Straight Ave., S. W., Grand Rapids, Mich., U. S. A.

VITRIFIED

Grinding Wheels

When improved results are expected, more than the grinding wheel must be considered.

"Vitrified" supplies not only a superior grinding wheel but recommends equipment that will fit each job exactly.

The Vitrified Sales Representative can solve any grinding problem you may present. Ask to have him call at your plant.

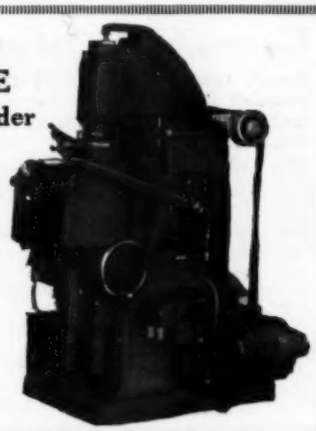
Borite is the recommended abrasive unequaled for Carbon and High Speed Steel Grinding.

Carborite insures absolute results when applied to cast iron, unannealed malleable iron (Borite for malleable) iron, brass, aluminum, bronze, etc.

VITRIFIED WHEEL CO.

Westfield, Mass.

The Walker SINGLE-STROKE Rotary Surface Grinder

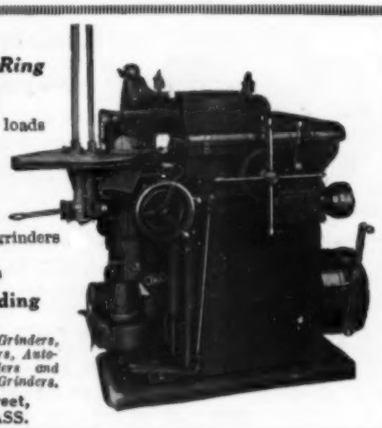


increases production and eliminates spoiled work through its simple semi-automatic operation whereby all controls are operated through one lever. Equally at home on Toolroom or Production work.

Write for Bulletin.

O. S. Walker Co., Inc.
Worcester, Mass.

ARTER
Automatic Piston Ring
GRINDER



The operator merely loads the magazine, the machine does the rest. He can operate three machines.

Production, 1000 ring sides per hour.

Twenty-seven of these grinders in one plant.

Get all the Facts

The Arter Grinding Machine Co.

Makers of Rotary Surface Grinders, Automatic Cylindrical Grinders, Automatic Piston Ring Grinders and Automatic Face and End Grinders.

72 Commercial Street, WORCESTER, MASS.

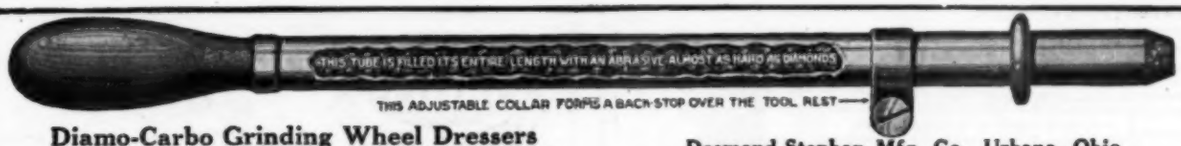
Grinding Machinery **Polishing Machinery**

DIAMOND MACHINE CO., PROVIDENCE R.I.

BADGER TOOL COMPANY

Grinding Machinery
Supplies and Accessories

E. B. GARDNER, President **R. D. GARDNER, Treasurer**
BELOIT, WISCONSIN, U. S. A.


THIS TUBE IS FILLED ITS ENTIRE LENGTH WITH AN ABRASIVE ALMOST AS HARD AS DIAMONDS
THIS ADJUSTABLE COLLAR FORMS A BACK-STOP OVER THE TOOL REST

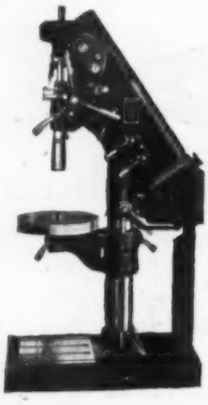
Diamo-Carbo Grinding Wheel Dressers

—consist of a steel tube filled with an extremely hard abrasive. For some purposes they are as satisfactory as diamonds—at only a fraction of the cost. Try them at our expense.

Our bulletin shows our complete line. Write for a copy.

Desmond-Stephan Mfg. Co., Urbana, Ohio

New England Representative: George L. Gaylord, Westfield, Mass. Canadian Desmond-Stephan Mfg. Co., Ltd., Hamilton, Ontario. Alfred Herbert, Ltd., Coventry, England. Paris, Milan, Yokohama.



Economy that is yours

It's the economy that's possible through the cost cutting qualities of Self Oiling All Geared Drills and Tappers.

Eight geared speeds and feeds. No cone belts to buy or to maintain and maximum speed combined with accuracy and durability are some of the features that make these machines real low cost, high production units.

Catalog "A" gives full information.

BARNES DRILL CO.
Inc. 1907
830 Chestnut St., Rockford Ill.
U. S. A.

Drilling an even dozen

When a prominent automobile concern wanted to cut production costs, they ordered a

U. S. MULTIPLE DRILL HEAD

This particular head drills 12 holes at a time. But we make any type to suit any particular need.

Let us know your particular problem.

United States Drill Head Co.
1954 W. 6th St.,
Cincinnati, Ohio
Michigan Agents—
National Sales Engrg. Corp., Detroit, Michigan

Broken Taps

start trouble and end in money loss. If you chisel the tap out, you spoil the threads, if you anneal it and drill it out, the same thing usually happens.

The Walton Tap Extractor will quickly remove the broken tap from the hole and never injure the threads. It usually pays for itself the first time used and makes big profits thereafter.

Stocked in sizes from 3/16-in. to 1-1/4-in. Larger and smaller to order.

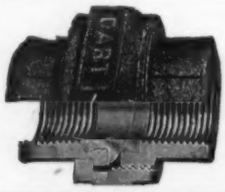
Send for illustrated bulletin giving full description and price list.

THE WALTON COMPANY
311 Pearl St., Hartford, Connecticut

Dreses Simplex Radial Drills
2½ x 3 Ft.

A Drill That Invites Comparison with Any of Its Type.

The Dreses Machine Tool Co., Cincinnati, Ohio



Leak-Proof Unions

Dart Unions are fitted with non-corrosive bronze seats. A free sample on request.

Write for catalog and price list No. 20.

E. M. Dart Mfg. Co., Providence, R. I.
The Fairbanks Co., Sales Agents
Canadian Factory, Dart Union Co., Ltd., Toronto.

Guaranteed Output

Range, speed and the rigid construction that guarantees accuracy make Silver Upright Drilling Machines full shift tools.

The 20-in. type has a 12 in. vertical spindle traverse. This enables you to profitably handle much of the work you now put on your big, expensive units.

There are many other features that will convince you of "Silver" superiority on your work.

Write for details now

The Silver Mfg. Co.
Box 360, Salem, O.
Established 1854

"MODERN EQUIPMENT CUTS COSTS"
Cut your Drilling, Boring, Lapping, Tapping, Reaming and Milling Costs by using a Multiple Spindle.

"HOLE HOG" DRILLER — BORER LAPPER—TAPPER REAMER SPECIAL MILLER

Catalogue on Request

MOLINE TOOL CO., Moline, Ill.

Speed up with **HOEFER** **Drilling Machines**

Their "minute-saving" features of design will greatly increase your drilling output and profits. Get the complete details from our branches in the principal cities.

HOEFER MFG. COMPANY
FREEPORT, ILL.

THE ROCKFORD DRILLING MACHINE CO. ROCKFORD, ILL., U.S.A.

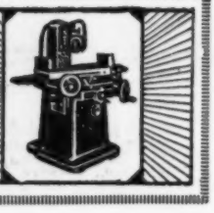
DRILLING Machines of all types—Gang Drills, Sensitive Drills, Sliding and Stationary Head Drills, Horizontal Drilling, Boring and Tapping Machines, Multi-Spindle Auxiliary Drilling Heads, etc.

Write us for Catalog

Rockford Drilling Machine Co.
Rockford, Ill.

Manufacturers of Precision
GRINDING MACHINES
Since 1900

Surface Grinders, Tool and Cutter Grinders and New Yankee Drill Grinders



WILMARTH & MORMAN CO.
1187 Monroe Ave., N.W. Grand Rapids, Mich.

NATCO
THE HOLE STORY IN ONE WORD

The "Hole" Story in One Word

THE NATIONAL Automatic Tool Co.
RICHMOND, IND.

Largest Exclusive manufacturers Multi-Drillers and Multi-Tappers

Write for full information.

Leland-Gifford
Sensitive
Drilling Machines

It's the little drills that want watching

The smaller sizes of twist drills must be driven at very high speed if full advantage of their efficiency is to be taken. Under ⅝ in. the necessary speeds run from 5,000 to 10,000 r.p.m. That puts ordinary drill presses out of the running, because they are not accurate enough to maintain such speeds without vibration.

Leland-Gifford Sensitive Drilling Machines, on the other hand, were specially designed to handle such work. Heavy precision construction of all parts, and ample ball bearings, give the measure of accuracy necessary to drive small drills at their maximum speed, day in and day out.

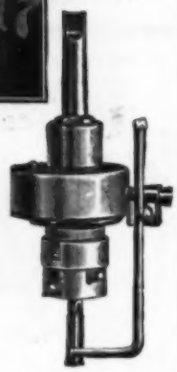
Write for full details.

Leland-Gifford Company
Worcester, Mass.

Errington Auto Reverse Friction Tapper
Style C.

Tapping Blind Holes in Air-Cooled Automobile Cylinder

(AMERICAN MACHINIST, Mar. 14, 1907)

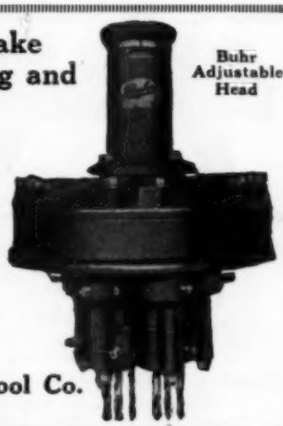


The breakage of a single tap on this job would cause an intolerable blemish in the appearance of the piece and result in heavy loss in time and money. The Errington Sensitive Adjustment and Quick Reverse insure perfect results. Regulate the power of the machine to just drive and remove all danger of breaking the tool or injuring the work. Fool proof, fits any drill press, and taps steel as safely as cast iron. Seven sizes, ⅜ in. to 2 in.

Errington Mechanical Laboratory
Broadway and John St., N. Y. City
Phone: Cortland 3149
New England Branch, 831 Old South Bldg., Boston, Mass.; Chicago Branch, 612 W. Adams St.; Catalog Francais, Edga Bloxham; Paris, 12 Rue du Delta

---

Put in Speed and Take Profits from Tapping and Drilling



Buhr Adjustable Head

The New Buhr Multiple Heads provide extreme accuracy with high production. Installed on your ordinary Drill Press it creates a multiple machine. It may be had in either the adjustable or fixed types.

We will be glad to furnish you with detailed data covering construction, operation and production possibilities.

The Buhr Machine Tool Co.
Ann Arbor, Mich.

Small Hole Drilling the Profitable Kingsbury Way—

Through the patented **Kingsbury Drill Head**, whereby the ingenious feeding principle approximates the "feel" of the human hand, sensitive Drilling can be automatically performed on all classes of work. **Holes at any angle; and in any number.** Also Reaming, Countersinking, Facing and Threading. **Write for Catalog.**

Kingsbury Mfg. Company
Keene, N. H.

DEMCO
High Speed, Sensitive, Ball Bearing
DRILLING MACHINES
The Drill Spindle without Vibration.
Write for information
Merit Oil Equipment Co., Morgan Ave., Cleveland, Ohio

BAKER

Vertical Boring and Drilling Machines
Cylinder Borers
Keyseaters.

BAKER BROTHERS Inc., TOLEDO, OHIO U. S. A.

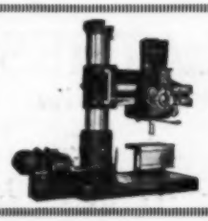
See Display in First and Third Issue of Month

Standardize on FOOTBURT *Drilling, Boring, Tapping Machines*
FOR PRODUCTION!

Leading manufacturers of Single and Multiple Spindle Drilling Machines, Cylinder Boring Machines, etc., and various types of special equipment.

THE FOOTE-BURT CO.
Cleveland, Ohio

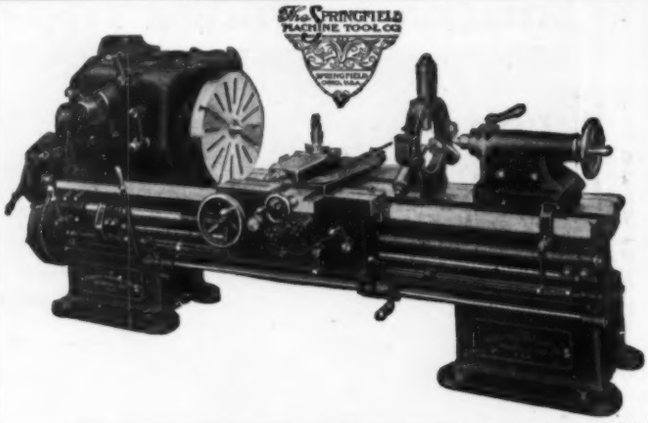
Pioneers in Better Drilling Methods



Five Years Satisfaction

The Carlton All Ball Bearing Radial Drill pleases its users. Has done so for **FIVE YEARS** and will continue to do so. Learn all its features and you'll see why.

The Carlton Machine Tool Co.
Cincinnati, Ohio, U. S. A.



SPRINGFIELD

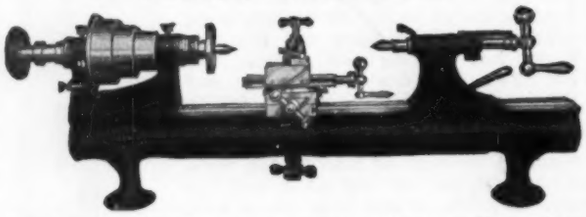
All Geared Head Engine Lathes

An up-to-date lathe meeting every possible range requirement and soundly recommended whenever investment is considered.

Made in sizes from 14-in. to 26-in. swing
Send for Circular No. 141 with full particulars.

The Springfield Machine Tool Co.
Springfield, Ohio, U. S. A.

Stark Precision Bench Lathes
Handier, Faster, More Accurate



than heavier machines on many classes of light, exacting tool or production work. Six sizes from ¼-in. to 1¼-in. collet capacity will fill every requirement.

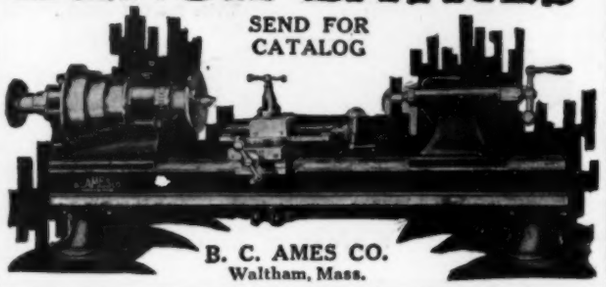
STARK TOOL COMPANY, WALTHAM, MASS.

Established 1862

ORIGINATORS OF THE AMERICAN BENCH LATHE

AMES
BENCH LATHES

SEND FOR CATALOG

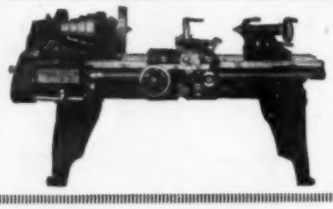


B. C. AMES CO.
Waltham, Mass.

Belt Grinder

For flat grinding any kind of a finish on anything. Motor driven from lamp socket.

Write us
THE PORTER-CABLE MACHINE CO.
Syracuse, N. Y.



INVESTIGATE

The New Line of
SOUTH BEND LATHES
Before you Buy

The Biggest Lathe Value in 25 Years. *Write for Catalog No. 86.*

South Bend Lathe Works
248 E. Madison St., South Bend, Ind.

FLATHER LATHES

The design incorporates the most advanced principles of modern machine tool practice—backed by over fifty years' experience as specialists in this field.

Sizes from 14-in. to 26-in.

Request Our Catalog for Details

The Flather Co., Nashua, N. H., U. S. A.

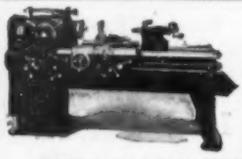
The New Semi-Automatic

Lo-swing Lathe

New Methods of Tooling

Send Blue Prints for Time Estimate

Seneca Falls Machine Co., Seneca Falls, N. Y.
Former Corporation Name: Fitchburg Machine Works
Also Makers of "Star" Engine and "Short Cut" Lathes



C & J
LATHES

We specialize in 13 in., 15 in. and 16 in. Geared and Cone Head Lathes.

THE CARROLL-JAMIESON MACHINE TOOL CO.
Davis Rd., Batavia, Ohio

"FOX" *All-Geared Motor Driven* LATHES

Compact, motor-driven machines that are adapted for any place in the shop.

Write for particulars of all sizes.

Bardons & Oliver, Cleveland, O., U. S. A.

BRADFORD LATHES

Cone or All-Geared Belt or Motor Drive

Sizes 14 to 42 inch

See full page ad First issue of each month.

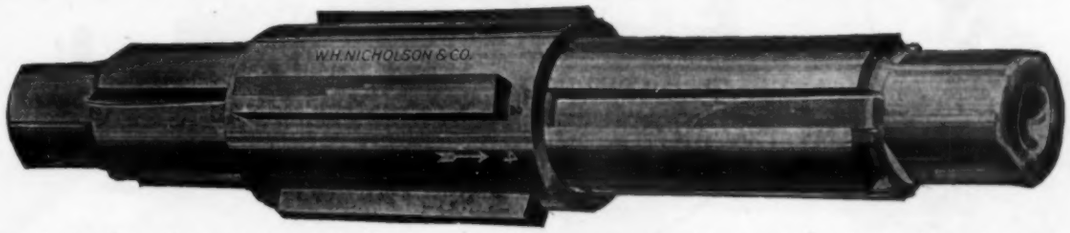
The Bradford Machine Tool Co., Cincinnati, O.

STEINLE TURRET LATHES

A modern high power, high duty production turret Lathe for bar or chucking work. Designed and built sufficiently powerful and rigid to enable use of greatest number of multiple cutters and thus insure rapid, accurate and economical work. Why not write us for full particulars.

STEINLE TURRET MACHINE CO.
MADISON, WIS. U. S. A.

NICHOLSON EXPANDING MANDRELS



A mandrel is in reality an internal chuck. You wouldn't want to do without a lathe chuck, then why continue operating without expanding mandrels in your shop? A letter or card will bring you complete information.

W. H. Nicholson & Co., 114 Oregon Street, Wilkes-Barre, Pa.

A quick start and a quick finish!

The quicker the "get away" on a job, the sooner will the work be finished. That's the reason why such high output figures have been obtained on the

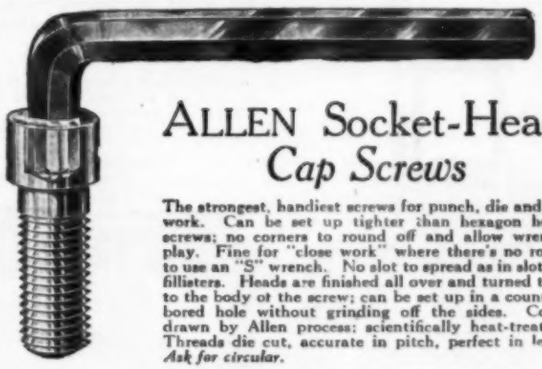
GIANT Keyseater

Set up time is almost negligible. Simply s l i p the w o r k over the grooved tool part. It is chucked positively and accurately by the bore only, while the down pull of the cutter bar prevents slipping and chatter. **GIANT** Keyseaters are made to hold to limits of accuracy as close as .001 inch. They can be operated easily by an unskilled hand.

Write for the details. They will prove interesting.

This sample was cut in 40 mins. including set up.

MITTS & MERRILL
Saginaw, Mich.



ALLEN Socket-Head *Cap Screws*

The strongest, handiest screws for punch, die and jig work. Can be set up tighter than hexagon head screws; no corners to round off and allow wrench play. Fine for "close work" where there's no room to use an "S" wrench. No slot to spread as in slotted fillisters. Heads are finished all over and turned true to the body of the screw; can be set up in a counterbored hole without grinding off the sides. Cold-drawn by Allen process; scientifically heat-treated. Threads die cut, accurate in pitch, perfect in lead. *Ask for circular.*

THE ALLEN MFG. CO. 129 SHELDON ST., HARTFORD, CONN.

WADE Toolmakers' Bench Lathe

The utmost in convenience and service for all work up to engine lathe capacity

Details on request.

THE WADE TOOL CO.
49-59 River St., Waltham 54, Mass.

Legible Trade-Marks

bring confidence to your products. We design trade-marks and manufacture marking machines and marking dies that last. *Write today.*

THE NOBLE & WESTBROOK MFG. CO.
19 Asylum St., Hartford, Conn.

Rivett
Precision Lathe

Nothing Better
Get Our Catalog
RIVETT LATHE & GRINDER CORP.
Brighton District of Boston, Mass.
The old masters of the art of toolmaking.

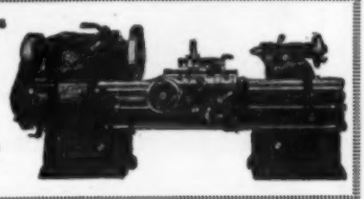
Lapping Machinery
Precision Measuring Machines
Amplifying Dial Gauges
Write for Illustrated Booklet—FREE.
Bethel-Player & Co., Ltd.,
17 Philpot Lane
London, E. C. 3.

1856 **WICKES** 1926

Heavy Duty Plate and Structural Tools, Heavy Duty Engine Lathes, Special Production Lathes and Crankshaft Turning Equipment, Blue Print Machines

WICKES BROTHERS—Saginaw, Michigan
501 Fifth Ave., New York City 736 White-Henry Building, Seattle, Washington

G-K Heavy Duty Lathes
—have proved their ability to turn out both quality and quantity production. Ask men who use them.
Send for a G-K Catalog.
The Greaves-Klusman Tool Company
Cincinnati, Ohio



NIAGARA

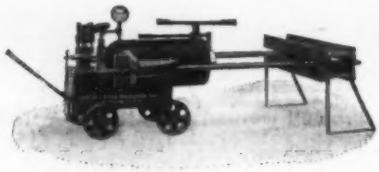
Sheet Metal Working Machines and Tools
PRESSES—PUNCHES
SQUARING SHEARS—ROTARY SHEARS
and Smaller Machines and Tools For the Sheet Metal Shop
Free Bulletins on Request

NIAGARA MACHINE & TOOL WORKS
ESTABLISHED 1879 BUFFALO, N. Y., U. S. A.
Philadelphia Office: 617 Harrison Bldg. Pittsburgh Office: 615 Park Bldg.

No. 2299
Travels to and from the work via Crane

E-HYDRAULIC-S
PRESSES PUMPS CHICAGO
SINCE 1851

EVERYTHING HYDRAULIC



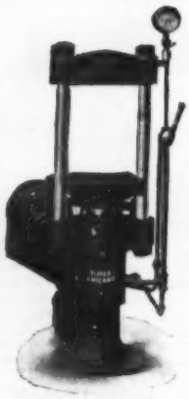
No. 2297—Wheel it to the work

Hydraulic Heavy Lifting Jacks

No. 258
Jack travels to and from the work on Pump Truck

Elmes Stationary and Portable Forcing Presses

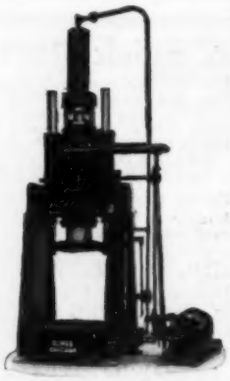
The Most Serviceable Shop Maintenance Tools. Handy in Pump Pits, Mine Shafts, Ship Holds, Power Stations, etc.



No. 2328
Armature Press

No. 2779 forces locomotive crank pins in and out at track without dropping wheels or axles.

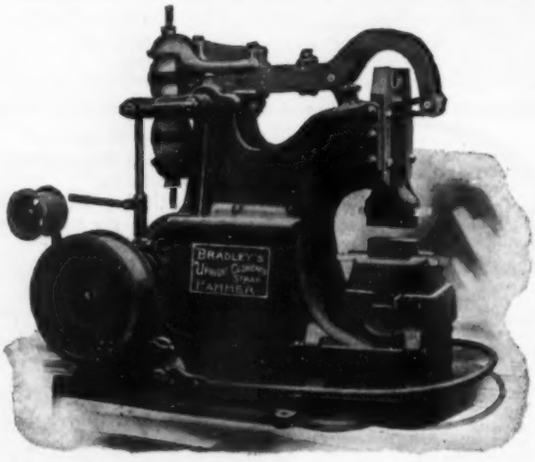
No. 2779 Locomotive Crank Pin Press



No. 2768
High Speed Straightening Press
100 pcs. per hour and up

CHARLES F. ELMES ENGINEERING WORKS
1001-1013 Fulton St., Chicago, U. S. A.

Bradley Upright Strap Hammer

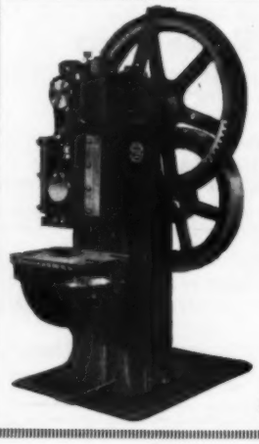


Better Forging Means Less Machining

You can save many hours of costly machining by forging parts on Bradley Hammers. The adjustable anvil block makes accurate alignment of dies a simple matter; the rubber cushions give the blow a quality of "snap" without jar; while length of stroke and strength of blow are controllable within very close limits. As a result, a fine degree of finish can be attained, with very satisfactory production figures.

Bradleys are made in many sizes and styles. The type illustrated shows up best on intermittent general work. May we help you select the machine for your particular job? Write us.

C. C. Bradley & Son, Inc.
Syracuse, N. Y.



"ADRIANCE"
Punch Presses

Sturdy tie-rod construction assures long life for press and tools, with expedition and accuracy of performance in punching, bending, forming and perforating operations.

ADRIANCE MACHINE WORKS,
INCORPORATED
84 Richards St., Brooklyn, N. Y.

The Hjorth Lathe is busy all day—

This precision bench lathe handles light and medium jobs of turning, drilling, screw cutting, milling, etc. It's a versatile unit that will cut production costs because it is never idle.

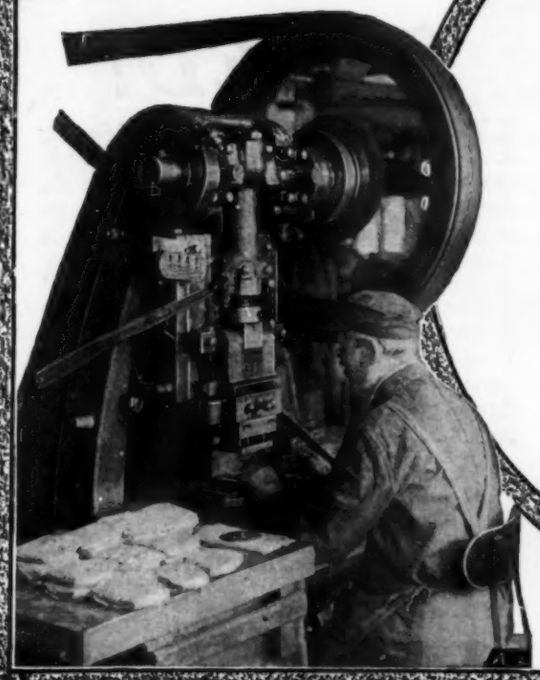
Send for further information

HJORTH LATHE & TOOL CO.

Manufacturers of the Hjorth Bench Lathes and Attachments, Submerged Drilling Attachments, Internal Grinding Attachment, Marking Machines, Spring Winders, Reamers, Etc.

Office: 10 Tremont St., Boston, Mass.
Works: Woburn, Mass.

Precision—



It's easy to turn out accurate work swiftly on a Bliss Press. In this case, for example, the operator perforates in a single day 2000 face plates for combination lighting switches—each face plate set to a register gage so as to be interchangeable.

A Bliss Press will assure similarly accurate and speedy work in *your* sheet-metal operations. Ask us for additional information and shop records of Bliss machines doing work similar to yours.

BLISS *for* MACHINERY

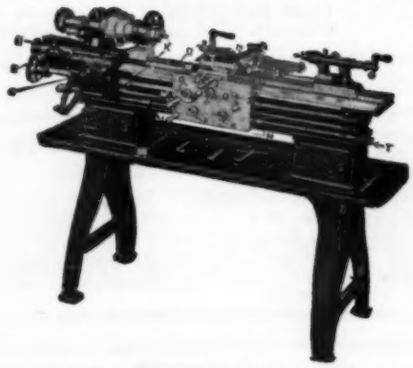
E. W. BLISS CO., BROOKLYN, N. Y., U. S. A.

Factories: Brooklyn, N. Y. Hastings, Mich. Salem, O. Cleveland, O.
Sales Offices: Detroit Cleveland Chicago Pittsburgh Philadelphia Cincinnati New Haven Rochester
Foreign Factories and Offices: London, Eng. Turin, Italy Paris, France

BLISS

No. 431

CATARACT LATHE
will trim production costs



The QUICK CHANGE SWING PRECISION LATHE

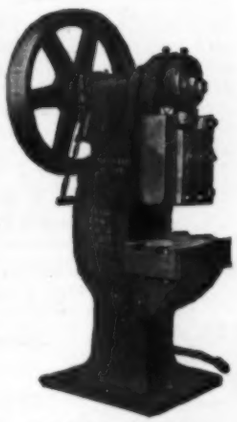
A versatile machine designed to handle a large amount of general shop and tool room work with speed and precision. A Cataract Lathe is a real cost-cutting lathe.

It embodies a great range of feeds; it is easy to set up, change and operate. Write for catalog giving complete details.

HARDINGE BROTHERS, Inc.
4149 Ravenswood Ave., CHICAGO, ILLINOIS

THE
"TOLEDO"
PUNCHING PRESSES

THE "TOLEDO" Punching Presses are especially suited for punching, shearing and cutting out blanks of heavy metal—steel, iron, brass, etc.; for operating trimming and forming dies used in the manufacture of automobiles, motorcycles, bicycles, cutlery, sewing machines, typewriter parts, agricultural implements, etc., switchboard parts and numerous other articles formed from bar and sheet metal.



"Toledo" Punching Press, No. 34-P

"PRESSES FOR EVERY PURPOSE"
Estimates furnished—correspondence solicited

The Toledo Machine & Tool Co.
Toledo, Ohio
Chicago Office: Room 611 Machinery Hall, 549 W. Washington Blvd.
Detroit Office: Room 3—250 General Motors Bldg.

The MORSE

High Speed Forged Type Drills

with the oversize shank, are designed to meet the demand of production jobs for drills of the staunchest character.

It will pay you to investigate

MORSE High Speed and Carbon Tools Sold by Reliable Dealers Everywhere.

MORSE
TWIST DRILL & MACHINE CO.
NEW BEDFORD, MASS. U.S.A.

SPEED!

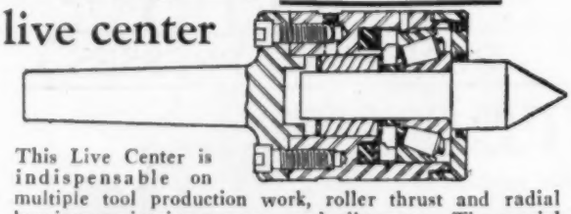
H & G Die Heads on all kinds of stock make it possible to cut threads at a high rate of speed that are accurate in lead, pitch, diameter and thread form, and with minimum of cost and freedom from troubles. There is a size and style of H & G Die Head for every machine on which threads are cut. Style "A" is for all automatics where the die rotates and for use on threading machines and bolt cutters. Used in such machines as Cone, Gridley, Acme, New Britain. Sizes ¼ in., 7/16 in., 9/16 in., 1 in., 1¼ in., 1½ in., 2 in., 2½ in., 3 in., 4 in, and 5 in.

Send for new catalog with a report of the Thread Commission.

The Eastern Machine Screw Corp.
20-40 Barclay St., New Haven, Conn.

DIE HEADS **H&G** PERFECTED THREADING

Self-aligning frictionless live center



This Live Center is indispensable on multiple tool production work, roller thrust and radial bearings maintains accuracy and alignment. The special oil resisting resilient pad absorbs shocks, eliminates pitting and cracking bearing surfaces, compensates for elongation caused from heat.

Send for details.

PRECISION GAUGE & TOOL CO.
6482 Epworth Blvd., Detroit, Mich.

"Libby-International" Turret Lathes

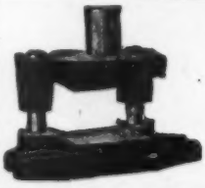
Full Swing Side Carriage, Heavy Duty Type Machines, covering Bar Work from 2 in. to 12 in. and Chucking Work up to 26 in. in diameter. Dealers in all principal cities.

International Machine Tool Co., Indianapolis, Ind.

No. 6 Roll Feed and Power Straightener

Will feed stock .137 in. thick—4 in. wide from 0 in. to 11 in. in length. Specially adapted for hinge and heavy hardware work.

F. J. LITTELL MACHINE CO.
4125-27 Ravenswood Ave.
Dept. A CHICAGO, ILL.



Sub Presses and Die Sets

Immediate shipments from stock.

Write for catalog

U. S. TOOL COMPANY, Inc.
Dept. A.M., Ampere, N. J.
2401 Chestnut St., Philadelphia, Pa.

V&O POWER PRESSES

Automatic Feeds
Automatic Threading Machines

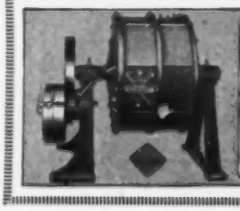
THE V. & O. PRESS CO., Hudson, N. Y.

L-J Presses Can't Be Beat

L-J Presses can't be beat for quality, production and durability. They are finely designed, well built, neat in appearance and equipped with a "sure fire" non-repeat tripping device.

Let us send you complete details.

Loshbough-Jordan Tool & Machine Co.
ELKHART, INDIANA



ABBOTT
Steel Bearing Balls
Burnishing Barrels
Balls—Pins—Cones
The Abbott Ball Co.
1042 New Britain Ave.
Hartford Conn.

International Standard Scleroscope (Hardness Tester)

The Scleroscope

is now used in hundreds of plants for its accuracy in hardness testing. It is direct reading and can readily be operated by anyone. Ranges from softest metals to hardest steels without adjustment. It is invaluable in ordering material to specifications. The free booklet will interest you.

The Shore Instrument & Mfg. Company
Van Wyck Ave. and Carrl St.
Jamaica, N. Y.

Agents for British Empire, Coats Machine Tool Co., Ltd., London S.W. Japan, Messrs. Yamatake Company, Tokyo. France, Aux Forges de Vulcain, Paris, etc.

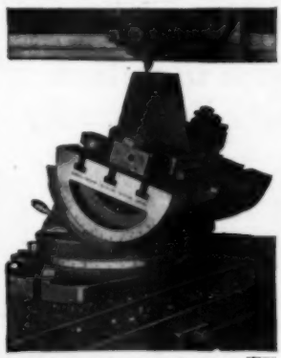
Converts a *Plain* Machine into a *Universal* Machine

—whether it be a Grinder, Milling Machine, Planer, Shaper or Drilling Machine.

This moderate priced accessory is really a universal holding fixture, invaluable in the toolroom as well as on production runs.

Cuts down set-up time; quickly provides the means for machining compound angles; serves well as a right angled knee and it saves time on many operations.

Horizontal motion 360°; vertical motion 120°. Fitted with vernier scales reading to 5 minutes.



Boston Scale & Machine Co.
100 Ruggles St., Boston, Mass.

The Boston Universal Angle Plate

Tycos temperature instruments

PLANT Managers and Production Engineers know that when slack methods are employed in any one department of a plant, the cost figures rise. This is especially true in departments where temperature control is a big factor in the processing of parts.

There is a "just right" temperature for every hardening, tempering and annealing process. A few degrees above or below this "right" point means a rejected tool or part.

Tycos Instruments will prevent such losses and thus pay for themselves over and over again.

Tell us about your temperature requirements and we will show you how to eliminate them.

Taylor Instrument Companies
Rochester, N. Y., U. S. A.
Canadian Plant, Tycos Building, Toronto
Manufacturing Distributors in Great Britain
Short & Mason, Ltd., London

There is a Tycos or Taylor Temperature Instrument for every purpose.

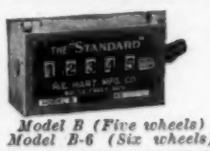
AMES
Micrometer Dial GAUGES

A Model for every purpose

SEND FOR CATALOG

B. C. AMES CO.
Waltham, Mass.

FEDERAL
DIAL INDICATORS
for Gauging —
DEPTH-PITCH
THICKNESS
ROUNDNESS
LEAD-ETC.
FEDERAL PRODUCTS CORPORATION
PROVIDENCE, R.I.



Model B (Five wheels)
Model B-6 (Six wheels)

MODEL B GEAR COUNTER
will give you your accurate production. Tested 20,000 per hour.

Send for circular

R. E. HART MFG. CO., MERRILL PARK BATTLE CREEK, MICH.

STEEL TYPE OUTFIT $35.00

WE MAKE OTHER MARKING TOOLS

GEO. T. SCHMIDT, Inc.,
4100 Ravenswood Ave., Chicago

FOR ACCURATE **The Productimeter** PRODUCTION RECORDS

Get the right count with the Productimeter, on punch presses, screw machines, drill presses, shears,—any type of production unit. We specialize in "counting" problems and assist you to make the proper application. Write for and keep the Productimeter Catalog on file.

DURANT MFG. CO.,
660 Buffum St., Milwaukee, Wis.

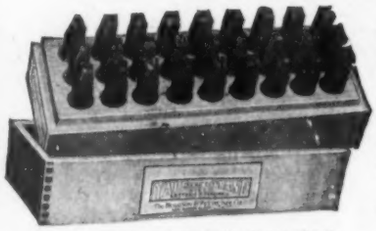
DIE MAKING MACHINE
"Saves an average of 50%"
"We wonder how we ever got along without it."

Dies, templets, experimental parts, gages and the like can be sawed, filed and lapped on the Oliver of Adrian Die Making Machine much easier, more accurately and in a fraction of the time ordinarily required for hand-work.

Our Bulletin tells the whole story.

Oliver Instrument Co., Adrian, Michigan.
New York City Branch, 139 Lafayette St.

YALE HAND CUT STEEL LETTERS & FIGURES BRAND



Showing handy set of Yale Brand Steel *Hand cut* figures.

YALE BRAND LETTERS and FIGURES give sharper impressions—because hand cut..

They last longer because we use high grade tool steel tempered by our own special process.

All sizes from 1/64-in. to 1-in.

Write

THE HOGGSON & PETTIS MFG. CO.
New Haven, Conn.

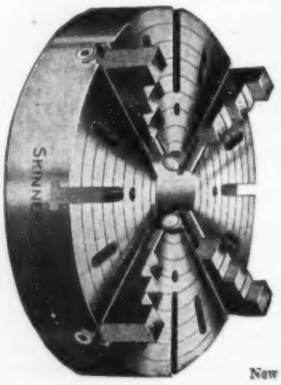
McCROSKY WIZARD Chucks

and Collets speed up drill press production

catalog on request.

McCrosky Tool Corp'n.
MEADVILLE, PA.

See our display in first issue of each month



SKINNER CHUCKS

The Standard for Accuracy in Operation

THE SKINNER CHUCK COMPANY
Established 1887
NEW BRITAIN, CONN. U.S.A.

and
New York Chicago Cincinnati San Francisco

No drawback rods to reduce spindle capacity

There are no drawback rods in the makeup of the Ney Positive Grip Work Holder to reduce the capacity of the spindle for bar work. As an economical machining unit it has no peer—its six collets do the work of eighteen ordinary ones. Irregular bar stock—round or hex—is gripped without adjustment. Write for our Illustrated Folder, describing its other good points.

The J. M. Ney Co., Hartford, Conn.

CUSHMAN LATHE CHUCKS

There is so much to tell about our Chucks as we build them to-day that in no less space than that of our Latest Catalog can we even approach doing justice to them.

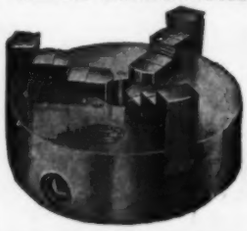
SHALL WE SEND YOU CATALOG NO. 42 ?

The Cushman Chuck Company
Hartford, Conn.

We Make Nothing But Chucks

Union Chucks are always "up to the minute." Our entire efforts are devoted to the development of chucks and every dollar expended in a Union assures ample returns in service. Correct design and proper materials give Union Chucks the stamina to stand hard usage.

Union Manufacturing Co. New Britain, Conn., U.S.A.



Branch Offices Where Stock is Carried:
New York Office: 26 Cortlandt St.
Cincinnati Office: 306 Sycamore St.
Chicago Office: 25 S. Jefferson St.
San Francisco Office: 770 Folsom Street

Makers of a Complete Line of Chucks

Our Catalog shows full line. Send for your copy.

AUTOMATIC CHUCKS AND TAPPING ATTACHMENTS

WAHLSTROM TOOL CO.

5524 SECOND AVE.
BROOKLYN, N.Y.

Use **Casler Offset Boring Heads**

to reduce cost of jigs, fixtures and experimental work and Casler Twin Screw Drill Chucks to reduce cost of manufacturing.

Send for Catalogues

HERMAN CASLER, Canastota, N. Y.

BARKER Wrenchless Chuck

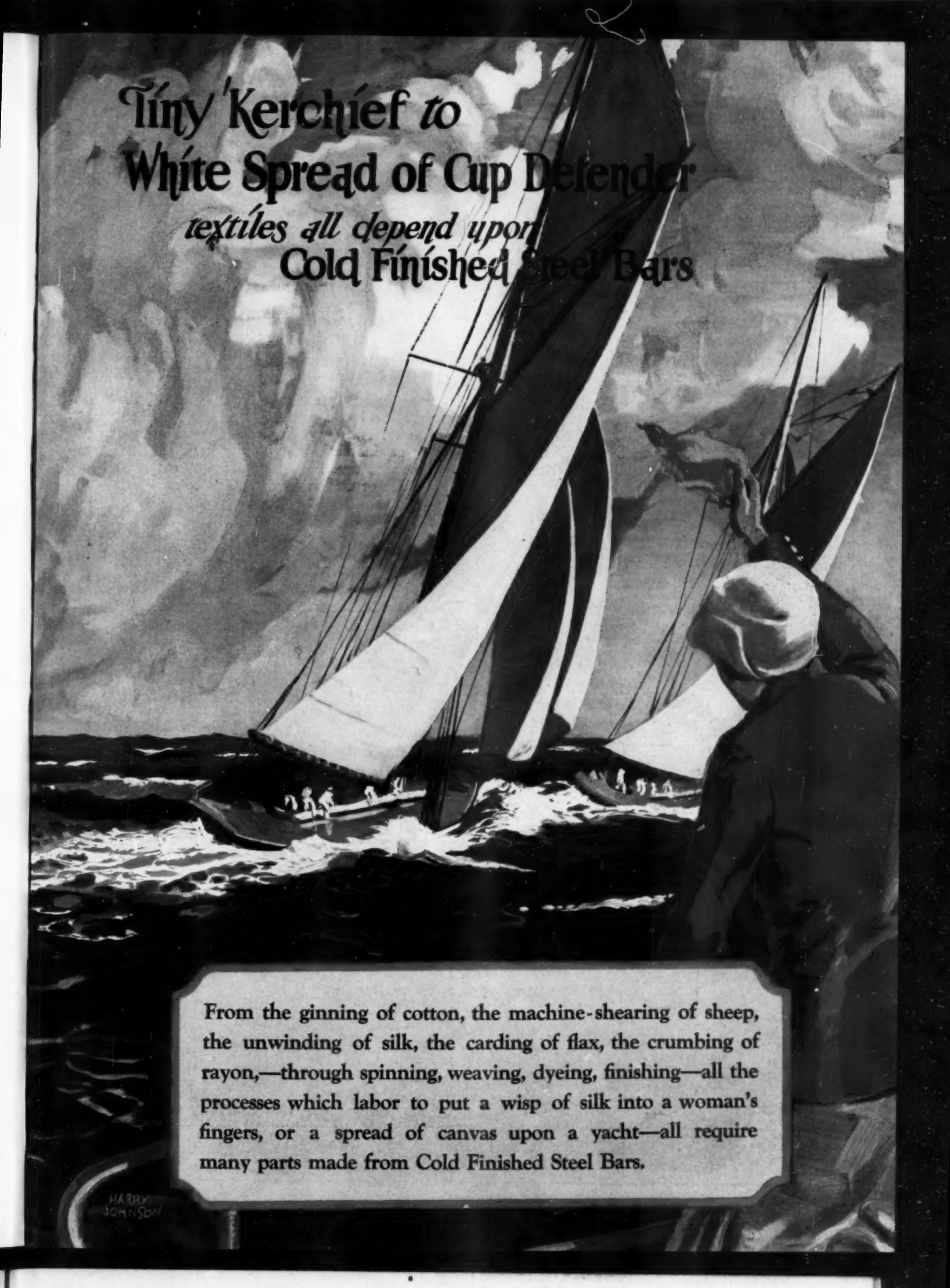
Constructed for the rapid production of duplicate parts. Saves wrenching and adjusting time consumed by ordinary chucks.

THOMAS ELEVATOR CO.
27 S. Hoyne Ave., Chicago, Ill.

ECONOMY CENTER POINTS

The removable points may be changed without the aid of special tools and without disturbing the point holder.

Atwood Manufacturing Equipment Co., Anderson, Ind., U. S. A.


Tiny Kerchief to
White Spread of Cup Defender
textiles all depend upon
Cold Finished Steel Bars
From the ginning of cotton, the machine-shearing of sheep, the unwinding of silk, the carding of flax, the crumbing of rayon,—through spinning, weaving, dyeing, finishing—all the processes which labor to put a wisp of silk into a woman's fingers, or a spread of canvas upon a yacht—all require many parts made from Cold Finished Steel Bars.
HARRY JOHNSON

The Vital Parts of *Textile Machines* are made from Cold Finished Steel Bars

A textile mill of 86,000 spindles means ten, twenty, a hundred times that number of Cold Finished Steel parts,—rods, bars, spindles, guides, to say nothing of innumerable screws, bolts, and nuts—all requiring accuracy, strength and economy. Tons of Cold Finished Steel Bars are used in the parts of hundreds of textile units.

Take, for instance, the delicate and complicated automatic looms which produce involved patterns on the minute scale of 150 threads to the inch without the error of a single thread.

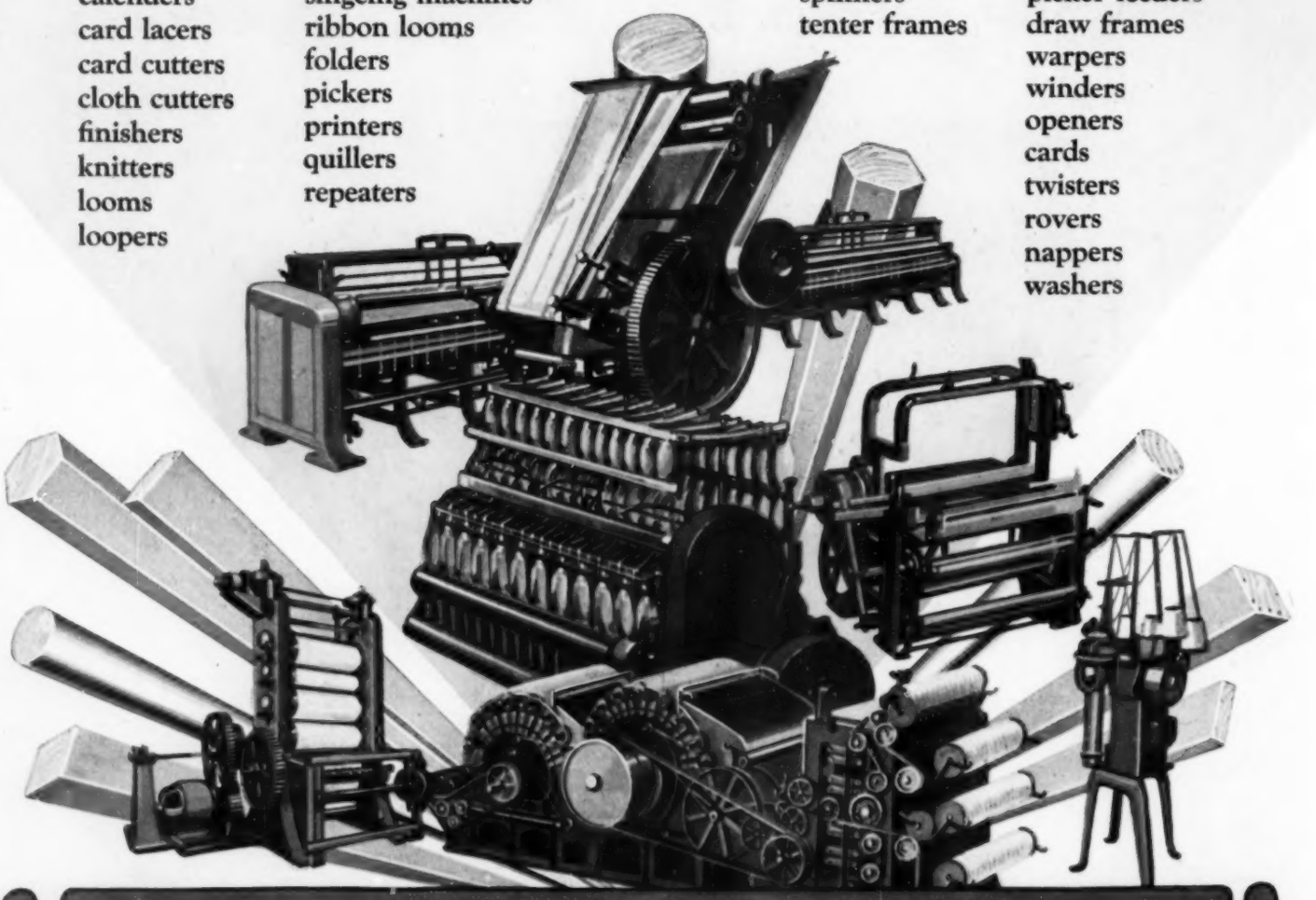
They are actuated by a perforated roll like a player-piano, but into the perforations, instead of air, slip hundreds of pins of Cold Finished Steel, each one pulling up by long strings, one, two or twenty threads of the warp while the shuttle flies through. Not merely do these machines require the characteristics of Cold Finished Steel for their proper operation, but their makers find great economy in the use of Cold Finished Steel Bars for the rapid automatic production of duplicate parts.

Identical results obtain through the whole range of textile machines. Some require hundreds, many require thousands of parts of this universal material. The industry's equipment is full of it; it is literally true that not a yard of fabric, not a spool of thread, could be economically produced without it.

It is the purpose and the hope of the Cold Finished Steel Bar Industry (*The Industry within an Industry*) to secure to manufacturers of this class of equipment still greater economies and improvements through a larger use of Cold Finished Steel Bars.

A few of the hundreds of Textile Machines, many parts of which are made from Cold Finished Steel Bars.

braiders
calenders
card lacers
card cutters
cloth cutters
finishers
knitters
looms
loopers
measuring machines
singeing machines
ribbon looms
folders
pickers
printers
quillers
repeaters
skein dyers
spinners
tenter frames
bobbin winders
picker feeders
draw frames
warpers
winders
openers
cards
twisters
rovers
nappers
washers



The Cold Finished Steel Bar Industry

This is but one of the many branches of industry dependent upon the use of Cold Finished Steel Bars for the economical production of small parts.

CONRADSON Die-Cast Reamer

(PATENTED)

25 to 50% SAVING

On Original Purchase Price

Guaranteed

Equally as Efficient as the conventional solid high speed steel type

---

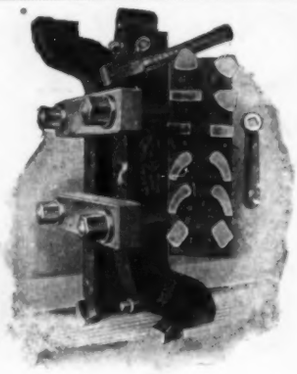
Send us your order on thirty day trial basis

All sizes from $1\frac{3}{16}$ to 3 in. inclusive

CONRADSON TOOL CORP., 2661 Clay St., Detroit

(Some Territories Still Open)

O.K. Cutting Tools



Keep the Wheels Turning

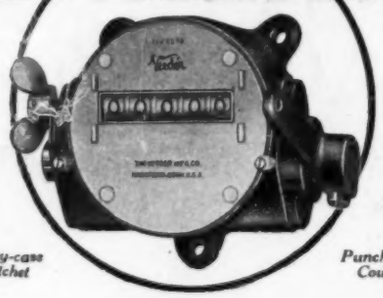
A constant supply of sharp, keen cutting tools is always at hand where the O.K. method is in operation. One man does all the grinding while the lathe men keep working.

O.K. tools are interchangeable and may be replaced *without* disturbing the holder. Their tough, enduring edges cut on and on.

O.K. tools and the O.K. method mean greater production. Let us prove it.

THE TRADE O.K MARK TOOL CO., INC.
SHELTON, CONN.

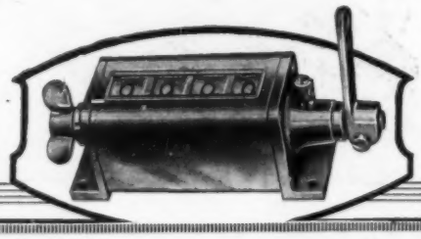
Veeder



Heavy-case Ratchet — *Punch Press Counter*

Your labor-saving machines *raise the limit* of what your workers can do. But your workers will only *GO* the limit when it's clearly defined and clearly *required* by the production-reports of Veeder Counters. Write for booklets showing counters for *all* machines.

THE VEEDER MFG. CO., 15 Sargeant St. Hartford, Conn.



DAVIS KEYSEATER

A simplified Keyseater that will handle the widest range of work including gear blanks, pulleys, bell cranks, crank handles, oil grooving, etc.

Write for illustrated bulletin!

DAVIS KEYSEATER CO., 255 Mill St., Rochester, N. Y.

B~C Hobs Milling Cutters

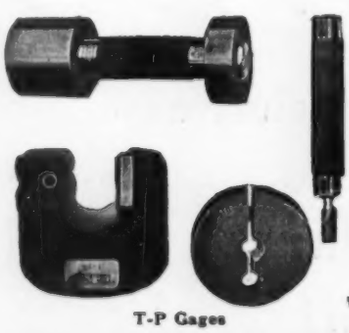
BARBER~COLMAN COMPANY
Rockford, Ill., U.S.A.

TAPS and DIES

REGISTERED TRADE MARK C

The Famous "Carpenter Quality"
Precise—Uniform—Durable
J. M. Carpenter Tap and Die Company
Oldest Tap and Die Makers in America
Pawtucket Rhode Island

Your Inspection Department Needs Taft-Peirce Gages



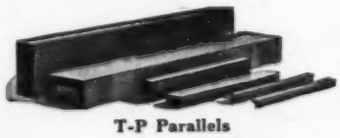
T-P Gages

T-P Gages are exact inspectors—nothing gets by unless it's accurate.

The easiest way to satisfy these stern taskmasters is to use T-P toolroom specialties—parallels—V-blocks—angles—knees—bench plates. The complete line is made for the purpose.

Wherever ACCURACY is sought, and attained, Taft-Peirce Products are standard equipment.

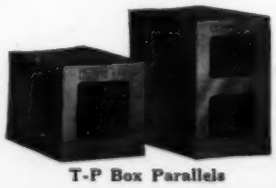
Send for Bulletin 1131-A.



T-P Parallels

THE TAFT-PEIRCE MFG. COMPANY
WOONSOCKET RHODE ISLAND, U.S.A.

Manufacturers of Gages, Small Tools, Reamers, Magnetic Chucks, Thread Millers, etc., and makers of Special Machinery and Tools on Contract.



T-P Box Parallels

RYERSON MACHINERY

RYERSON Machinery includes a complete line of improved Machine Tools and Metal Working Equipment of all kinds. A competent staff of experienced engineers is always available for consultation on any of your equipment problems.

Write for a complete catalog

Lathes	Bevel Shears
Drills	Milling Machines
Planers	Horizontal Drills
Shapers	Bending Rolls
Punches	Pneumatic Machinery
Shears	Hydraulic Machinery
Small Tools	Spring Shop Equipment
Friction Saws	Flue Shop Equipment

JOSEPH T. RYERSON & SON INC.

CHICAGO MILWAUKEE ST. LOUIS DETROIT
BUFFALO CINCINNATI NEW YORK

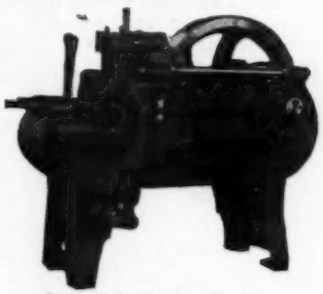
"PAWTUCKET"

BOLT FORGING MACHINERY

Perhaps you are interested in making SMOOTH FORGED bolts.

If so, you can gain useful information by writing for full particulars to

Pawtucket Mfg. Co.
313 Barton St.
Pawtucket, R. I.



⅞-in. Bolt Forging Machine

H. B. Underwood Corp.

Established 1870 Philadelphia, Pa.

Remember this name

when engines break down!

Emergency repairs day and night—call

UNDERWOOD'S
POWER PLANT REPAIR CREW

Need Security?

Whether your requirements are for maintenance or production, Mac-it screws will meet your needs and save dollars in repair bills.

Practically 100% satisfaction with their use. You get:

Fast assembly
Firm adjustment
Strength and Safety

No danger of breakage, no splitting, no need to dig out a broken screw, but continuous, uninterrupted service.

Mac-its are especially adapted for dogs, dies, machine tool fixtures and wherever there is frequent adjustment. Invaluable where there is constant jar and vibration. For high speed machinery where hollow screws are required and where safety is considered. Should be used for intricate machinery where security is demanded.

All types. All sizes. The illustration shows a Mac-it Hollow and a Mac-it Square-head set screw. Made from Mac-it special alloy steel, heat treated scientifically, tempered to meet specific needs.

Ask your dealer for them or write:

The Strong, Carlisle & Hammond Co.
General Distributors
1392-1394 West Third St.
Cleveland, Ohio

Remember this when buying taps

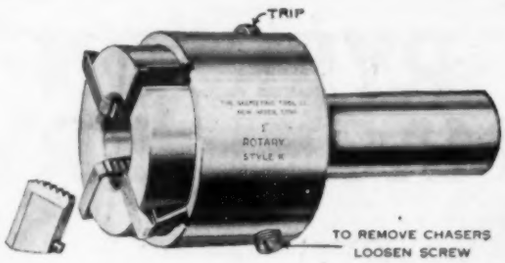
Ground Thread Taps like those shown here would be impossible but for the interest of our workmen in their work, which impels them to give their best to the production of Threadwell Taps. Themselves users of good tools, they appreciate the value of accuracy—nothing but perfect workmanship satisfies them. Come to Threadwell and learn why high standards *do not* mean a higher unit tool cost.

THE THREADWELL TOOL CO.
Greenfield, Mass.

Detroit, Mich.
Cleveland, O.
Philadelphia, Pa.
Indianapolis, Ind.

San Francisco, Cal.
Rochester, N. Y.
Richmond, Va.
Pittsburgh, Pa.

New York, N. Y.



A New Rotary

These Geometric Rotary Die Heads are designed with particular reference to the various types of Multiple Spindle Automatics and other Live Spindle Machines.

They are of small diameter, swinging freely in the limited space afforded by many of the modern Automatic Screw Machines.

Construction is most simple—only three units—enclosed against dirt or chips.

The Geometric Tool Co.
New Haven, Conn.

FLYNN Offset Boring Head

A mechanically-perfect precision head of simple design and few parts.

All parts of heat-treated nickel steel.

This compact head has the least overhang of any Head on the market, yielding utmost rigidity and maximum table travel.

Made in a full range of sizes to fit all standard spindles and arbors.

Send for descriptive bulletin and price list.

J. M. Waterston, 426 Woodward Ave., Detroit, Mich.

Adjustment Simplicity

To change the diameter of the PAROB Reamer, you merely use a screw driver. There are no nuts nor exposed screws to become lost nor damaged and nothing can slip when once adjusted.

PAROB
(Parallel Oblique)
Expansion Hand Reamers

are unique, but mechanically correct in design. Each straight blade is preceded and followed by an angular blade. This prevents chatter and thus insures a smooth finished hole. Get the details.

The Gammons-Holman Co.
Dept. A — Manchester, Conn.

Use ARMSTRONG Tool Holders

Save
All Forging
70% Grinding
90% Tool Steel

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. Francisco Ave., Chicago, U. S. A.

Twist Drills, Reamers

See our Page advertisement, June 3rd issue.

Screw Extractors

BUCKEYE

Twist Drills, Reamers and Special Tools

THE BUCKEYE TWIST DRILL CO., ALLIANCE, O.

Chicago Office, 542 West Washington Blvd.

"Canned Experience"

Make use of the other man's experience

That old saying

about experience being the best teacher is absolutely sound in one sense. But most of us recite it without thinking that experience may be of various sorts—the experience of other men as well as our own, "canned experience," if you please, ready for use. Just open and serve yourself! Why not take advantage of the experience of other men as far as we can and save not only years of time but many expensive lessons?

Do you know how much of the world's best research in the machine shop field is contained in

McGRAW-HILL BOOKS?

That single fact or table may be worth many times the price of the book to you.

Buy Your Books on the Budget Plan

Choose Any

of these McGraw-Hill Books that you would like to see—one, or two or a half dozen—as many as you wish. Read them for ten days free—keep those you want—send back those you don't want.

Pay for the books you keep as you use them. If you keep $15 worth of books, send $3.00 in ten days and $3.00 monthly. The smallest monthly payment is $3.00. If you keep $6 worth of books, send $3.00 in ten days and $3.00 a month later.

The monthly installments must be large enough so that the entire account will be paid in full within six months.

Prices are the same as cash—there is no extra charge for the monthly payment privilege.

1

Stanley—

PUNCHES AND DIES

434 pages, 6x9, 618 illustrations, $4.00

The complete manual on the layout, construction and use of punches and dies.

2

Palmer—

PRACTICAL CALCULUS FOR HOME STUDY

443 pages, pocket size, flexible, illustrated, $3.00

This book gives the man with limited mathematical training a thorough understanding of how to make use of the calculus in his work.

3

Clark—

SHOP AND OFFICE FORMS

139 pages, 6x9, 37 illustrations, $2.50

This book helps to simplify shop and office work and to obtain more effective control of it. It discusses the functions of forms, their proper design, their economical use.

4

Heck—

MECHANISM

500 pages, 6x9, illustrated, $5.00

A thorough treatment of the whole field of motions and forces in machines.

5

Heck—

KINEMATICS AND DYNAMICS

550 pages, 6x9, 658 illustrations, $5.00

The second part of a two-volume treatise covering such topics as the kinematics of displacement, velocity and acceleration, the graphics of machine forces, the mechanics of the piston engine, vibration, balance testing and gyrostatic action, friction and lubrication, and engine governors.

6

Dowd and Curtis—

PUNCHES, DIES AND GAGES

341 pages, 6x9, illustrated, $3.50

A practical, detailed discussion of dies and gages for practically all uses. Covers every important part of die and gage work. Gives you up-to-the-minute practice. Special attention given to die and gage design.

7

Dowd and Curtis—

JIGS AND FIXTURES

293 pages, 6x9, 232 illustrations, $3.00

This book covers the important points in the design of jigs and fixtures, explains methods and principles and gives many graphic illustrations of their application.

8

Dowd and Curtis—

FIXTURES FOR TURNING, BORING AND GRINDING

340 pages, 6x9, 216 illustrations, $3.50

This book deals with the factors of importance which affect the design of tools and fixtures for turning, boring and grinding.

9

Diemer—

FACTORY ORGANIZATION AND ADMINISTRATION

New Fourth Edition, 391 pages, 6x9, illustrated, $4.00

A standard work on factory practice in both organization and administration thoroughly revised and brought up to date.

10

Marks—

MECHANICAL ENGINEERS' HANDBOOK

New Second Edition, 2,000 pages, 4x7, flexible, illustrated, $6.00

The best accepted engineering theory and practice in those branches of most interest to the mechanical engineer.

Choose the books you want to see and mail just the coupon

Mail just this coupon to see these McGraw-Hill Books

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York.

Send me the books checked for 10 days' free examination:

- ..... Dowd and Curtis—PUNCHES, DIES AND GAGES, $3.50.
- ..... Dowd and Curtis—JIGS AND FIXTURES, $3.00.
- ..... Dowd and Curtis—FIXTURES FOR TURNING, BORING AND GRINDING, $3.50.
- ..... Diemer — FACTORY ORGANIZATION AND ADMINISTRATION, $4.00.
- ..... Clark — SHOP AND OFFICE FORMS, $2.50.
- ..... Palmer — PRACTICAL CALCULUS, $3.00.
- ..... Heck — KINEMATICS AND DYNAMICS, $5.00.
- ..... Stanley — PUNCHES AND DIES, $4.00.
- ..... Heck — MECHANISM, $5.00.
- ..... Marks — MECHANICAL ENGINEERS' HANDBOOK, $6.00.

I agree to return such books as I do not wish to keep, postpaid, within 10 days of receipt, and to remit at the same time my first installment and the balance in equal installments each month. Minimum monthly payments, I understand, are $3.00, and also that account is to be paid in full within six months.

Name .....

Home Address .....

City .....

Position .....

Name of Company .....

A 6-24-26

GITS BROS. OILERS

For Every Lubrication Need

275 STYLES AND SIZES

Send for our Catalogue

OUR WIRE WICK OILERS

For the discriminating Executives and Engineers who want a SLOW FEEDING SYSTEM that

1. Easy to fill.
2. Assures a constant flow.
3. Cannot be clogged by dirt.
4. Needs no attention after the flow is once adjusted to conditions.
5. The cup acts as a reservoir which prolongs the flow of oil indefinitely.

GITS BROS. MANUFACTURING CO.
1943 South Kilbourne Avenue, Chicago

When We Mounted The Motor

on the spindle under the pan we made the Curtis Centrifugal Oil Extractor still more a Leader. It is the only extractor, so far as we know, possessing this advantage.
A Curtis will do better than pay for itself. It will pay regular dividends. Curtis handled chips are dry chips.

Send for a Catalog.

Leon J. Barrett Co.
Successor to
The Curtis Machine Co.
Worcester, Mass.

Getting Oil and Grease Off Quickly

Use one of our Soda and Potash Kettles for cleansing your newly-made machine parts. And for removing paint, dirt and grease in repairing automobile and machinery parts. Cheaper than gasoline and less dangerous. It has many other uses. *Send for circular and prices.*

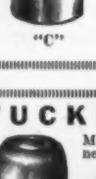
The Gray & Prior Machine Company
69 Suffield Street
Hartford, Conn., U. S. A.

"A"

They meet every Lubricating Condition

"B"

Large manufacturing schedules and simplicity of construction combine to make these Bennett Oil Cups the market's best buy. Used for twenty years on all types of machinery. Write for catalog prices.



"C"

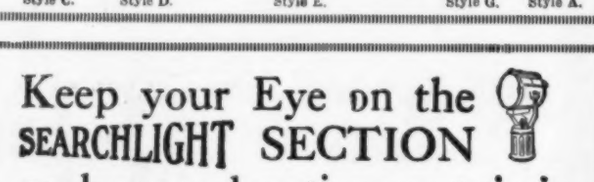
BAY STATE STAMPING CO.
380 Chandler St., Worcester, Mass.

BENNETT
HANDY TOP OIL CUP

"D"

TUCKER OIL HOLE COVERS

Made in a variety of styles and many sizes to suit all needs. Send for descriptive catalog and price list.
W. A. & C. F. Tucker, Inc.
Hartford, Conn.



Also Hand Shears and Rod Cutters

COLT AUTOSAN
Metal Parts Washing Machine

More correctly cleaned parts per hour at less cost per part. Large capacity, automatic operation. Minimum overhead and supervision costs. Send for your copy of illustrated, descriptive Circular.

Colt Patent Fire Arms Mfg Co Hartford Conn

Keep your Eye on the SEARCHLIGHT SECTION and your advertisements in it

612

TWIST DRILLS, CUTTERS, REAMERS AND SPECIAL TOOLS

NATIONAL
TWIST DRILL & TOOL CO.
DETROIT, U.S.A.

Kent-Owens

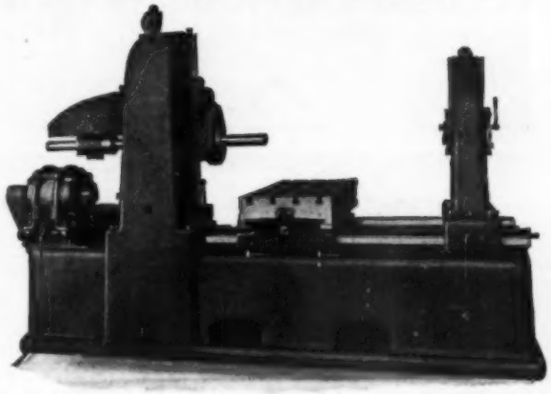
CAMS

For 30 years Kent-Owens has been building cams. These have covered a wide diversity in size and design. This experience qualifies us to build cams at the least cost.

Whether your requirements are for large quantities, or only a few cams we will submit prices promptly on receipt of your blue prints.

The Kent-Owens Machine Co.
958 Wall St., Toledo, Ohio

UNIVERSAL
HORIZONTAL
BORING MACHINES



No. 24 Tri-Way, (Back View)
Showing the motor on the bed

Greatest Advance in Horizontal Boring Machine Design in Twenty Years.

UNIVERSAL BORING MACHINE COMPANY
HUDSON, MASS., U. S. A.

NATIONAL CLEVELAND
"Extra Service" Tools

Milling Cutters, Spur and Worm Gear Hobs, Reamers, Interchangeable Counterbores, Special Tools.

The National Tool Co., Cleveland, Ohio

New York, 41 Murray St.; Philadelphia, 816 Chestnut St.; Chicago, 624 Madison Terminal Bldg., 9 So. Clinton St.; Detroit, 5—116 General Motors Bldg.

IF

YOU HAVE WORK TO GIVE OUT WRITE TO THE RELIABLE CONCERNS IN THE CONTRACT WORK SECTION.

DAVIS
COMPLETE UNITS

Micrometer Adjustment Boring Bars
Expanding Cutter Blocks and Bars
Expansion Multiple-Bladed Reamers

GUARANTEED
Superior
To Any Similar Tools

Supported by
TWENTY-THREE
YEARS' SERVICE

Provide an efficient and economical tool for every boring and reaming operation for use on any make or style of machine.

Davis Boring Tool Company
Incorporated
Forest Park Blvd. at Spring Ave., St. Louis, Mo.

Largest Exclusive Manufacturers of EXPANSION BORING TOOLS and EXPANSION REAMERS

SEARCHLIGHT SECTION

USED MACHINERY & NEW—BUSINESS OPPORTUNITIES

UNDISPLAYED—RATE PER WORD:
Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.
Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.
Proposals, 40 cents a line an insertion.

INFORMATION:
Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.
Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:
1 to 3 inches.....$5.00 an inch
4 to 7 inches..... 4.80 an inch
8 to 15 inches..... 4.60 an inch
An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

A.M.

POSITIONS VACANT

Illinois

ENGINEERS — A Chicago manufacturer has several vacancies for mechanical engineers. The men we want are graduates of a recognized university and have had several years' industrial experience since leaving school. Possibilities of promotion later to executive positions to those qualifying are excellent. To receive favorable consideration, give age, education and complete details of experience, also starting salary expected. Replies confidential. P-57, American Machinist, 7 So. Dearborn St., Chicago, Ill.

MECHANICAL engineer, recent college graduate for mechanical development work. Must be well informed in fundamentals relating to mechanical engineering and possess a working knowledge of engineering principles. A general training with ability to analyze and suggest new methods of manufacture is more desirable than a specific knowledge of any given subject. Location Chicago. P-58, American Machinist, 7 So. Dearborn St., Chicago, Ill.

New York

EXECUTIVE wanted, capable of supervising two hundred employees; must be thoroughly experienced in buffing, polishing, nickel plating, japanning, lacquering, and as a matter of fact anything pertaining to metal finishing. A man who has had some years of practical experience, with a thorough understanding of chemistry, preferred. Must be able to furnish best of references. P-978, American Machinist, Tenth Ave. at 36th St., New York.

TOOL, die and gage makers, experienced on high grade interchangeable work. These openings are offered by long established manufacturing concern located within a few miles of Newark, N. J. State fully experience, age and rate expected. P-47, American Machinist, Tenth Ave. at 36th St., New York.

WANTED
DRAFTSMEN
Experienced, familiar with heavy machinery, preferably presses for sheet metal work.
Apply with full particulars to
THE TOLEDO MACHINE & TOOL CO.,
Dorr St. and N. Y. C. R.R., Toledo, O.

WANTED
MECHANICAL DRAFTSMEN
Men familiar with layout and detail in elevating, crushing, and conveying machinery.
In your letter give detailed account of your experience, age, nationality, salary expected, and date you can report for work.
Aluminum Company of America
Massena (St. Law. Co.), N. Y.

POSITIONS VACANT

Massachusetts

TWO first-class machine designers wanted. State salary expected. Only first-class experienced men considered. Salary to correspond to ability. Apply only in writing. Reed-Prentice Company, 677 Cambridge Street, Worcester, Mass.

WANTED — Designer of real ability, capable of designing machinery for special milling and grinding operations. P-60, American Machinist, Tenth Ave. at 36th St., New York.

Canada

AN experienced man wanted to take charge of piece work department in factory manufacturing electric generators, motors, switchboards and general line of electrical apparatus. Must have mechanical experience on machine tools as well as bench. Apply stating age, education, experience, to Canadian General Electric Co., Peterboro, Ont.

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000 and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established sixteen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 266 Main Street, Buffalo, New York.

EXECUTIVES, engineers, find our individual, confidential service effective in making new connections. Personally planned by Mr. Jacob Penn, the eminent employment authority, known to leading machinery manufacturers throughout America. Refund agreement protects you. Not agency. Jacob Penn, Incorporated, 305 Broadway, New York.

EMPLOYMENT AGENCY

GENERAL engineering agency, Emich Bldg., Pittsburgh. Require for transcontinental proposals: Plant designing engineers, machine tool draftsmen, production supervisors, sales engineers, specialized records especially solicited. Employers served freely everywhere.

POSITIONS WANTED

New York

DESIGNER and checker, tools and fixtures, desires permanent position. PW-48, American Machinist, Tenth Ave. at 36th St., New York.

Executive as works manager or assistant to general manager, by one with long extensive training and experience in all modern methods.
PW-59, American Machinist
Guardian Bldg., Cleveland, Ohio

POSITIONS WANTED

SALES MANAGER — A hustler, open for engagement either in full charge or to handle important branch not as productive as desired. Technically trained. Can sell and manage others. Stimulates sluggish sales. Fully experienced, location East, South or New England preferred. Address PW-2, American Machinist, Tenth Ave. at 36th St., New York.

MANAGER-EXECUTIVE—Offers his services to medium size manufacturing plant desiring new blood in its business. Can organize, systematize, analyze; competent to assume full charge. Can handle manufacturing, sales, advertising, etc. Technically trained. Of especial value to concern desiring to expand or to one that has become stagnated. Location, preferably East. Address PW-1, American Machinist, Tenth Ave. at 36th St., New York.

SUPERINTENDENT, an executive with tact, initiative, good technical education, fifteen years charge of manufacturing and general shop work, including costs, handled difficult problems successfully, designed jigs, fixtures for economical production. PW-50, American Machinist, Tenth Ave. at 36th St., New York.

Notice to Advertisers

Owing to the holiday—Monday, July 5th, for the official observance of Independence Day—the *"Searchlight"* pages of the July 8th issue of

American Machinist

will close for press a day earlier than usual. Therefore

Changes of Copy

and **New Advertisements,** including those under the Employment classifications, should reach us by

5 P.M. Wednesday, June 30th

POSITIONS WANTED

New Jersey

SUPERINTENDENT or general foreman. Practical mechanic, age 40, twenty years' shop experience; past twelve years in charge of building machine tools, special machinery and automotive equipment; able to handle men and produce. Salary $3,800. PW-36, American Machinist, 10th Ave. at 36th St., New York.

Ohio

FACTORY manager or superintendent for machine shop, 45 years old; plenty of initiative and inventive ability; 20 years' executive experience, thorough mechanic in all branches; thorough knowledge latest shop methods, systems, production, and employment problems, and a technical education in general business administration. PW-970, American Machinist, Guardian Bldg., Cleveland, Ohio.

SALESMEN WANTED

Salesman

for machine tools and production equipment. Must be thoroughly experienced and should be practical mechanical man for eastern machinery dealer. Some traveling required and will pay salary and commission. Reply in confidence. SW-55, American Machinist, Tenth Ave. at 36th St., New York.

PATENT ATTORNEYS

PATENTS—Send for form "Evidence of Conception" to be signed and witnessed. Form fee schedule, information, free. Lancaster and Allwine, 262 Ouray Bldg., Washington, D. C.

PATENTS. Booklet free. Highest references. Best results. Send drawing or model for examination and opinion. Watson E. Coleman, Patent Lawyer, 644 G Street, Washington, D. C.

C. L. PARKER

Ex-examiner U. S. Patent Office

Attorney-at-Law and Solicitor of Patents
McGill Building, Washington, D. C.

Patent, Trade Mark and Copyright Law

WANTED

MACHINE TOOL SALESMAN

To sell for prominent manufacturer in an Eastern territory. Applications desired only from first class men with selling experience.

A.S.-52, American Machinist,
Tenth Ave. at 36th St., New York City

Chicago Engineering Company, experienced in theoretical and practical modern machine shop and foundry methods, with sales office and warehouse, is interested in representing one or two lines of machine tools, machinery or high class mechanical specialties.

AS-61, American Machinist
7 So. Dearborn St., Chicago, Ill.

An Opportunity to Buy a Portable Electric Tool Business

from a company who manufacture a more complete line of portable electric drills, grinders, etc., etc., than any one other concern in that line. Address,

P. O. BOX 586, CINCINNATI, OHIO

FOR SALE

Complete Machine Shop Equipment

for manufacturing and repairing small machinery. Tools and machinery in fine condition. On account of old age, poor health and no successor, will sell for half of the price tools are worth. Write

S. Karas, Wausau, Wis.

WANTED

WANTED

DOUBLE CRANK PRESS

One used, Consolidated, geared, No. 104 or 105. State condition and best price.

JAMES STEELE, LIMITED
Guelph, Ont.

WE WANT TO PURCHASE

Universal Milling Machine

No. 3 or No. 4, with dividing head. Any good make will be considered.

WAYNE TOOL MFG. CO., Waynesboro, Pa.

Today's Prices Are Highest

Let "Searchlight" Help You

The quicker idle equipment is sold, the higher the selling price it can demand—today's prices are always highest because—

Equipment permitted to remain unused depreciates rapidly and occupies valuable space. Every day of idleness brings down the possible selling price.

"Searchlight" Locates Quick Buyers

The wise owner of idle equipment promptly informs the field of his desire to sell through an advertisement in the Searchlight Section, where he knows that those who might need what he has will be most likely to look first.

BUY NOW Before Machine Tool Prices Advance

Lathes

1—56-64-in.x30-ft. Johnson.
1—56-64-in.x24-ft. Johnson.
1—56-64-in.x18-ft. Johnson.
1—33-51-in.x42-ft. Le Blond.
1—33-51-in.x20-ft. Le Blond.
1—45-in.x24-ft. Pond.
1—44-in.x16-ft. Putnam.
4—40-in.x12-ft. Fifield.
2—36-in.x42-ft. Le Blond, M. D.
3—36-in.x37-ft. N.B.P., M. D.
1—36-in.x30-ft. Johnson.
4—36-in.x30-ft. Pittsburgh, G. H.
1—36-in.x24-ft. Pittsburgh, G. H.
1—36-in.x20-ft. Pittsburgh, G. H.
3—36-in.x14-ft. Johnson Triple Gd.
1—36-in.x12-ft. Wickes.
1—32-in.x12-ft. Wickes.
1—32-in.x12-ft. Pittsburgh.
2—30-34-in.x12-ft. Lodge & Shipley Selective Head.
1—30-34-in.x11-ft. Am. Gd. Hd.
3—30-in.x11-ft. H., S. & G.
2—27-in.x14-ft. Reed Pren. G. H.
2—26-in.x18-ft. Bridgeford.
4—26-in.x16-ft. Canada.
5—26-in.x16-ft. N. B. P.
2—26-in.x16-ft. Whit.-Blaisdell.
10—26-in.x16-ft. Bridgeford.
5—26-in.x14-ft. Bridgeford.
5—26-in.x14-ft. N. B. P.
2—26-in.x13-ft. Wickes.
3—26-in.x12-ft. Putnam.
5—26-in.x12-ft. Bridgeford.
13—26-in.x11-ft. Wickes.
30—26-in.x10-ft. N. B. P.
21—26-in.x10-ft. Canada.
15—26-in.x10-ft. Whit.-Blaisdell.
3—26-in.x10-ft. Walcott.
54—26-in.x10-ft. Bridgeford.
61—26-in.x9-ft. Bridgeford.
16—26-in.x8-ft. Bridgeford.
15—25-in.x12-ft. Le Blond.
5—25-in.x10-ft. Le Blond.
20—25-in.x10-ft. Sidney.
1—24-in.x15-ft. Chard.
1—24-in.x12-ft. Reed-Pren. G. H.
9—24-in.x10-ft. Cisco.
1—24-in.x10-ft. American.
1—24-in.x10-ft. Lodge & Shipley.
10—21-in.x10-ft. Le Blond.
5—20-22-in.x16-ft. American.
5—20-22-in.x12-ft. American.
1—20-in.x10-ft. L. & S. Pat. Hd.
3—20-22-in.x8-ft. American, M.D.
30—20-22-in.x8-ft. American.
5—20-in.x8-ft. Le Blond.
6—19-in.x8-ft. Le Blond.
1—16-in.x8-ft. Rockford.
2—14-in.x8-ft. Carroll Jamieson.
2—14-in.x6-ft. Carroll Jamieson.
1—Bogart Crankshaft.
4—8-in. Fitchburg Loswing.
5—3½-in. Fitchburg Loswing.

Gear Cutters and Hobbers

3—No. 36 SM Gould & Eberhardt.
2—24-in.x12-ft. Gould & Eberhardt.
3—No. 18-H Gould & Eberhardt.
1—No. 62 Fellows.
14—No. 6 Fellows.
1—No. 5 Lees-Bradner.
1—No. 1 Schuchardt & Schutte.
4—No. 1 Farwell.

Automatic Screw Machines

5—No. 6-A Potter & Johnston.
8—No. 5-A Potter & Johnston.
1—No. 56 2¼-in. National Acme.
1—2-in. Model A Cleveland.
3—No. 75 1⅝-in. National Acme.
1—1½-in. Model A Cleveland.
1—⅞-1¼-in. Cleveland.
4—⅝-⅞-in. Cleveland.

Drill Presses

1—No. 30 Natco.
1—No. D-31 Fox.
1—No. 41 Natco.

Drill Presses—Cont'd

1—No. 17 4-spdl. Foote-Burt. Rail.
1—No. 11 Natco.
1—No. 6 3-spdl. Moline Hole Hog.
1—24-in. Colburn.
1—No. 14 Colburn.
2—No. D-2 Colburn.
1—No. 24 Foote-Burt.
1—No. 513 Baker.
1—No. 310 Baker Comp. Table.
2—22-in. Barnes All Gd. Mfg.
2—20-in. Barnes Camel Back.
6—20-in. Silver Drills.
22—No. 1-K 8-in. Henry & Wright.

Radial Drills

1—7-ft. Western.
1—5-ft. Niles "Semi-Univ."
2—3-ft. American Sensitive.
1—3-ft. Carlton Sens.

Presses

1—96-G Toledo Double Crank.
2—No. DGG-56 Ferracute, Gd.
5—No. 58 Toledo Nosing.
1—No. 57 Toledo Nosing.
1—No. 69 Stoll.

Profilers

2—Pratt & Whitney, Auto.
34—2-spdl. Newton.
8—No. 1 2-spdl. Garvin.
14—2-spdl. Betts.

Grinders—Cont'd

2—12x36-in. Landis.
4—12x36-in. Modern.
4—12x36-in. Fitchburg.
1—10x96-in. Norton.
1—10x72-in. Landis.
3—10x72-in. Norton.
2—10x50-in. Norton.
2—10x36-in. Norton.
1—10x36-in. Landis.
1—10x24-in. Landis.
7—6x32-in. Norton.
2—6x18-in. Landis.
1—3½x36-in. Norton Cam.
1—22-in. P. & W. Surf.
1—No. 2 Cincinnati Univ.
1—No. 2 Fraser Univ.
1—No. 2½ Universal.
1—No. 20 Bryant Internal.
1—No. 10-A Bryant Internal.
1—Modern Internal.
1—No. 20 Heald Ring.
2—No. 16 24-in. Besly Ring Wheel.
1—3½x36-in. Norton Cam.
1—No. 6 18-in. Besly Ring Wheel.

Slab Milling Machines

1—No. 3 92x54-in.x15-ft. Beaman & Smith Milling and Boring Machine Planer Type.
1—Beaman & Smith Open Side.
1—3-spdl. Beaman & Smith.
1—32x32-in.x12-ft. Ingersoll.
1—24x13-in.x20-ft. Ingersoll.
1—24x24-in.x 8-ft. Ingersoll.
7—24x24-in.x12-ft. Ingersoll.

Planers—Cont'd

1—24x24-in.x6-ft. Rockford.
1—24x24-in.x6-ft. Hamilton.
1—24x24-in.x6-ft. American.

Hand Screw Machines

2—No. 10 Foster.
1—No. 10 3-in. Bardons & Oliver.
1—No. 5½ Bardons & Oliver.
3—No. 8 Warner & Swasey.
5—No. 6 2¼-in. Warner & Swasey.
1—No. 4½ 1¾-in. Bardons & Oliver.
4—No. 4 1½-in. Bardons & Oliver.
20—No. 3 1⅛-in. Foster.
6—No. 3 1¼-in. Bardons & Oliver.
15—No. 2 1⅛-in. Foster.
3—No. 2 1-in. Bardons & Oliver.
1—1x15-in. Pratt & Whitney.
2—No. 2 ⅝-in. Pratt & Whitney.

Turret Lathes

2—26-in. Libby.
9—25-in.x10-ft. Le Blond Univ.
26—24-in. Davis.
5—24-in. Steinle.
1—24-in. Gisholt.
2—21-in. Gisholt.
26—21-in.x10-ft. Le Blond, Univ.
3—20-in.x8-ft. American.
25—19-in.x8-ft. Le Blond.
24—19-in.x8-ft. Le Blond Univ.
1—18-in. Libby.
1—2-spdl. Jones & Lamson.
1—2½x26-in. Pratt & Whitney.
1—15x7-in. Bardons & Oliver.
2—14-in. Foster.
1—1½-in. Pratt & Whitney.

Milling Machines

4—No. 4 Cincinnati.
3—No. 4 Le Blond.
2—No. 4-B Heavy B. & S.
7—No. 3 B Heavy B. & S.
1—No. 3 B. & S.
9—No. 3 Kempsmith.
1—No. 2 Kempsmith.
4—No. 2-B Heavy B. & S.
1—No. 2-B—B. & S.
1—No. 1 Brown & Sharpe, Univ.
1—No. 28 Ohio.
1—No. 2 Rockford, S. P. D.
21—No. 3 Garvin.
16—No. 1 Van Norman, Hand.
31—No. 0 Bristol.
7—No. 6 Whitney, Hand.
3—Pratt & Whitney Cam.
1—4-in. Pratt & Whitney Spline.
7—Putnam Semi Auto.
1—No. 33 Kempsmith.
175—P. & W. Hendey, Becker and Garvin Lincoln Millers.

Vertical Millers

2—Model ACS 2-spdl. Becker.
3—Model SD Becker.
3—No. 5-C Becker.
3—No. 5-B Becker.
1—Model CS Becker.
3—Model B Becker.
3—No. 3 Cincinnati, Hi-Power.
6—No. 3 Brown & Sharpe.
1—Model AB Becker.
2—No. 4-B Becker.

Miscellaneous

1—No. 1½ Knight Milling & Drilling Machine.
1—24-in. Comb. Disc and Sander.
1—44-in. Norton Running Balance.
18—Pilton Slotters.
1—No. 2-X Garvin 4-spindle Vertical Tapper.
1—No. D-125 Fairbanks Hammer.
1—20-24 Dill Slotter.
3—No. 4 La Pointe.
1—No. 4 J. N. La Pointe.
1—No. 14 Cochrane-Bly Univ. Shaper.
1—2 Spindle Hoefer Cylinder Borer.

Our guarantee is concise and unmistakable: Your money back if you return a machine within thirty days, freight prepaid. No excuses necessary.

Horizontal Boring Machines

Table Type

1—2-spdl. Espen-Lucas Boring, Milling and Drilling Machine.
1—No. 3 Beaman & Smith Engine Frame and Cylinder Borer.
1—Beaman & Smith Cylinder Boring and Milling Machine.
1—36-in.x42-ft. Gisholt Gun Boring.
1—4-in. Bar Newark.
5—No. 1 Barrett.
7—Rockford.

Floor Type

1—5-in. Bar Detrick & Harvey.
1—3½-in. Bar Beaman & Smith.
1—4-in. Bar Giddings & Lewis.
1—3½-in. Bar Giddings & Lewis.
1—6½-in. Bar Landis.

Grinders

1—84-in. Diamond Face.
1—24x96-in. Norton.
1—20x96-in. Landis.
1—18-30-in.x96-in. Norton.
2—18x96-in. Norton.
3—14x72-in. Norton.
2—14x50-in. Norton.
1—14x48-in. Queen City.
1—14-22-in.x50-in. Norton.
1—12x120-in. Landis.

Thread Millers

2—6x14-in. Pratt & Whitney.
7—No. 3 E. Lees-Bradner.
3—No. 3 Lees-Bradner.
1—Holden-Morgan.
5—HM Foster.

Vertical Boring Mills

6—72-in. Gisholt.
1—72-in. Cincinnati.
1—72-in. Colburn.
1—62-in. King.
1—60-in. Pittsburgh.
1—53-in. N. B. P.
1—52-in. Gisholt.
2—42-in. Colburn.
1—42-in. Gisholt.
1—30-in. Bullard.

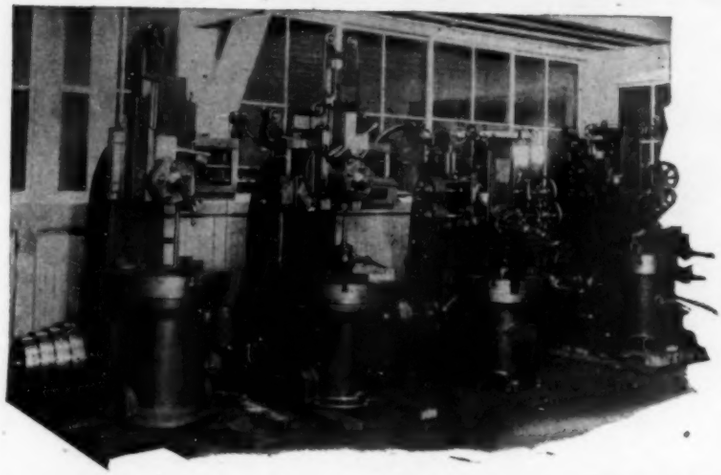
Planers

1—72x56-in.x36-ft. Cincinnati. 2 Hds. (Side hds. can be added.)
1—42x42-in.x22-ft. D. & H.
2—42x42-in.x16-ft. Rockford.
1—42x42-in.x9-ft. N. B. P.
3—36x36-in.x18-ft. Cincinnati.
1—36x36-in.x12-ft. Woodward & Powell, 2 Hds.
2—36x36-in.x10-ft. Bickett.
1—36x30-in.x20-ft. Whit.-Blaisdell.
1—36x30-in.x18-ft. Whit.-Blaisdell.
1—36x32-in.x12-ft. Gray.
1—30x30-in.x14-ft. N. B. P.
1—30x30-in.x10-ft. Woodward & Powell, 3 Hds.
1—24x24-in.x12-ft. Whitcomb.

Write for photoprints, descriptions and prices

HILL, CLARKE & CO.
OF CHICAGO
647 W. Washington Boulevard, Chicago
Cable Address: REMAND Phone: Haymarket 7660

ReMANUFACTURED
-(ORIGINATED BY US)-
MACHINE TOOLS
Reg. U. S. Pat. Off.



EVEN enthusiastic believers in new tools, concede that there are occasions which justify used machine tool installations in the shop, for economy purposes.

Consult this list of Good Used Machine Tools, for your needs!

Gear Cutters

6-in. Gleason, B.G. Generator.
24x8-in. Gould & Eberhardt, multiple spdl.
36-in. Gould & Eberhardt, spur and bevel.
No. 4—48-in. Brown & Sharpe, spur gears only.

Presses

Nos. 4 and 5 V & O.
Nos. 19 and 21 Bliss.
No. 3 Thomas.
No. 3 Sidney.
No. 52 Bliss.
No. 2½ Billings & Spencer Trimming.
200-ton Burroughs—Hydraulic.
3-in. Long & Allstatter, Bar Shear, Style "C."

Horizontal Boring Mills

No. 2 Rockford, table type.
No. 32 Giddings & Lewis, table type, 3⅛-in. bar.
Barrett Cylinder, Boring Type, 5-in. bar.

Millers

No. 0½ Cincinnati, Plain.
No. 25 Becker, Plain.
No. 1 Osterlein, Plain.
Nos. 2 and 2½ LeBlond, Plain.
Nos. 2, 3 and 4 Cincinnati, Plain.
Nos. 2 and 3 Kempsmith, Plain.
Nos. 2 and 3 Brown & Sharpe, Plain.
No. 2 Kearny & Trecker, Plain.
Nos. 2 and 3 Hendey, Universal.
No. 1 Kempsmith, Universal.
No. 2 Cincinnati, Universal.
No. 3-A Brown & Sharpe, Universal.
Nos. 3 and 4 Cincinnati, Vertical.
A. C. S. Becker, Vertical.
Type A and B Briggs, Manufacturing.

Grinders—Rotary, Surface and Disc

8-in. Heald-Rotary.
10-in. Garrigus-Rotary.
12-in. Heald-Rotary, No. 22.
No. 16 Blanchard-Rotary.
14-in. Pratt & Whitney 10x36-in. Magnetic Chuck.
12-in. Springfield Planer Type.
No. 2 Diamond 12x36-in.
No. 3 Brown & Sharpe.
No. 6 Besly double disc.

Vertical Boring Mills

24-in. Bullard, New Era.
34-in. Colburn, Turret Head.
72-in. Niles, 2 Heads.
102-in. Poole, 2 Heads.

Grinders—Cutter and Tool

No. 190 Wells.
No. 1 Cincinnati.
No. 2 Walker.
No. 1 Greenfield.

Grinders—Universal

No. 1 Brown & Sharpe.
12x36-in. Cincinnati.
12x36-in. Landis.
16x40-in. Landis.

Grinders—Plain

6x32-in. Norton.
10x36-in. Norton.
10x72-in. Norton.
10x20-in. Landis.
10x30-in. Landis.

Adjustable Spindle Drills

No. 41 Natco, 8 spindles.
No. 30 Natco, 10 spindles.
No. 17—4 spdl. Foote Burt
6-spindle Bickford.

Radial Drills

30-in. and 36-in. American, geared drive, tapping attachment.
42-in. Cincinnati, geared drive, tapping attachment.
60-in. Dreses, cone drive, tapping attachment.

Lathes—Miscellaneous

18-24-in.x6-ft. Rahn-Meyer-Carpenter, Gap.
8x60-in. Lo-swing.
16-in.x8-ft. Automatic Machine Co., automatic chasing.

Lathes

13-in.x 6-ft. American.
14-in.x 6-ft. Seneca Falls.
16-in.x 6-ft. American.
16-in.x 6-ft. Lodge & Shipley.
16-in.x 8-ft. Lodge & Shipley.
16-in.x10-ft. Lodge & Shipley.
16-in.x 8-ft. Le Blond.
17-in.x16-ft. Le Blond.
20-in.x12-ft. American.
24-in.x22-ft. Lodge & Shipley.
24-in.x10-ft. Lodge & Shipley.
24-in.x10-ft. American.
26-in.x 9-ft. Bridgeford.
30-in.x12-ft. Lodge & Shipley.
38-42-in.x20-ft. Schumacher-Boye.
40-in.x20-ft. Fish.
44-56-in.x27-ft. Fitchburg.

Grinders—Internal

No. 75 Heald.
No. 60 Heald—Cylinder Type.

Screw Machines—Automatic

⅜-in., ½-in., ⅝-in., ⅞-in., 2¼-in., 4¼-in. and 6-in. Cleveland.
¾-in. Gridley, multiple spdl.
3¼-in. and 4¼-in. single spdl.

Upright Drills

24-in. Barnes.
24-in. and 32-in. Cincinnati.
25-in. Weigel.
24-36-in. Cincinnati.

Sensitive Drills

No. 1—1 spindle Avey, B.B.
1 spindle Henry & Wright, B.B.
1 spindle Leland-Gifford, B.B.
No. ½—2 spindle Avey, B.B.
4 spindle Henry & Wright, B.B.
4 spindle Taylor & Fenn.
4 spindle Gardam.
1 spindle Clark, M.D.

Shapers

10-in. Pratt & Whitney.
12-in. Smith & Mills.
16-in. and 24-in. Gould & Eberhardt.
16-in. and 20-in. Flather.
16-in. and 20-in. Cincinnati.
20-in. American.
26-in. Smith & Mills.
20-in. Cincinnati — Traveling Head.

Screw Machines

Nos. 0, 1 and 2 Bardens & Oliver.
Nos. 1 and 2 Garvin.
¼-in. Wells.
1-in., 1½-in. and 2¼-in. Acme.
1-in. and 1½-in. Pratt & Whitney.
2½-in. and 3¼-in. Acme.
2-in. and 3-in. Jones & Lamson.

General Miscellaneous

Nos. 1 and 3 Lapointe Broaching Machines.
No. 1½ American Broaching Machines.
No. 2 Catlin Keyseater.
No. 2 Baker Bros. Keyseater.
3-in. and 6-in. Cutting-off Machines.
2-in. Acme Double Bolt Cutter.
2½-in. Acme Bolt Header.
No. 2 Garvin Vertical Tapping Machines.

Write for photograph, specifications and price of any tool listed here that interests you.

HENRY PRENTISS & COMPANY

149 BROADWAY, NEW YORK, N. Y.

BOSTON BUFFALO HARTFORD ROCHESTER SYRACUSE

Hunting the hard one—

WHEN you want a particular used tool that's hard to find on the market, let us know what it is. As large dealers and buyers we are constantly being offered first choice to purchase high grade tools of every description. We can find the unusual tool you want quickly, and at the right price, due to our known purchasing power.

Watch the MOREY List Every Week!

New and Rebuilt Modern Machine Tools

GUARANTEED!

Grinders

1—Queen City 14x72 Pl.
7—Norton 6x32, 10x36, 16x36.
1—Springfield 12x12x48 Ver.
1—Diamond 84-in. Guide Bar.
4—Cincinnati No. 2, 12x36.
1—Landis 18x64 Crank.
1—Fitchburg 12x54.
12—Bryant No. 20, No. 6 chucking.
2—Bryant No. 15 dble. spdle.
28—Heald Nos. 65, 60 & 70.
1—Van Norman No. 34.

Lathes

10—Hendey 14x6, 16x6, 16x8, taper relieving.
2—Mulliner 14x6, taper.
1—LeBlond 14x6, Q.C.G.
5—American 14x6, 16x8, SPD.
10—New South Bend 15x5, 18 x8 gap.
1—Bradford 16x12, Q.C.G.
2—Mueller 18x8, Q.C.G.
1—American 18x10, S.P.D.
1—Rahn-Larmon 18x14 ft.
1—American 20x8 ft. Cone.
1—American 20x10 ft. S.P.D.
2—LeBlond 21x12 Automobile.
1—LeBlond No. 6 Multi-cut.
3—LeBlond 26x10 Duplex Crank.
1—Bridgeford 26x12 ft. Q.C.G.
1—Walcott 26x14 ft. 6-in. Q.C.G.
1—LeBlond 27x16, S.P.D.
1—Greaves-Klusman 28x10.

Lathes—Continued

1—Johnson 30x12, motor drive.
1—Lodge & Shipley 30x16, geared hd.
3—Putnam 42x44 ft. geared head, double carriage, arr. for M. D.
3—Bridgeford 48x50 ft. heavy duty, geared head, double carriage, arr. for M.D.
1—American 60x34 in.; triple geared, cone dr.
2—Loswing 3½x84, 2 carriages.
New Star Lathes, all sizes, with all attachments.

Presses

1—Bliss No. 21 Knuckle Joint.
1—Bliss No. 39-B.
2—Bliss No. 19 geared, M.D.
3—Toledo No. 34-P, Geared.
1—Toledo No. 53
1—Toledo No. 857 Rack and Pinion.
2—Zeh & Hahnemann No. 8½, Percussion.
1—Stoll, No. 97 Toggle.

Planers

7—Putnam 26x26x8 ft., 2 hds.
1—W & P 24x24x10 ft.
2—Gray 38x38x20 ft. 3 hds., M.D.
1—Putnam 48x48x12 ft. 2 hds.

Boring Mills

1—Gisholt 48-in. ver.

Radial Drills

1—American 4-ft. univ., SPD.
1—Baush 6-ft.
1—NBP 96-in., m.d.

Drills—Multiple Spindle

1—Natco No. 14, rect. hd.
3—Baush No. 2, 3, 4.
1—Moline No. 17-D, 4 spdle.
1—Foote Burt No. 17, 6 spdle.
2—P & W No. 11.

Drills—Ball Bearing

1—New Avey No. 2½, 4 spdle, p. f.
1—New Turner No. 3, ver. turret.
2—Colburn No. D-4.

Automatic Screw Machines

1—B & S No. 6.
8—Gridley 4 spdle., 9/16-in., ¾-in., 1¼-in., 2¼-in.
12—Gridley s.s., 3¼-in., 4¼-in.
10—Cleveland Model B, ⅝-in., 1¼-in., 2¼-in.
12—Cleveland Model A, ⅝-in., ⅞-in., 1¼-in., 2¼-in., 7¾-in.
2—New Britain 1x5, 6 spdle.

For complete list of machines, write for our 64-page illustrated catalog.

MOREY AND COMPANY, INC.
410 BROOME ST., NEW YORK

Telephone: Canal 5360

PARTIAL LIST

Guaranteed Machine Tools

28-in. Gisholt Turret Lathe, belt driven.
No. 60 Heald Cylinder Grinder, No. 2133.
14x50-in. Norton Plain Cylinder Grinder.
12-in.x72-in. Norton Plain Cylindrical Grinder.
4x36-in. Pratt & Whitney, Plain Cylindrical Grinder.
30-in. Aurora Upright Sliding Head Drill.
No. 25 Foote-Burt Heavy Duty Drill.
3-ft. Fosdick Plain Radial Drill, Gear Box.
3-ft. Reed-Prentice Radial, latest type.
4-ft. Reed-Prentice Plain Radial, M. D. (2).
7-ft. Cincinnati-Bickford Plain Radial Drills, Gear Box Drive.
24-in. Hollingsworth Back Geared Crank Shaper.
10-in. Betts Slotter, belt driven.
36x36-in.x10-ft. Newton Slab Miller, 2 heads.
No. 54 Cleveland Straight Side Geared Press, wgt. 15,000 lbs., 24 in. between housings.
No. 2-M Potter & Johnson Automatic Miller.
No. 5-B Brown & Sharpe Plain Miller.
No. 2 Becker Vertical Miller.
No. 2 Pratt & Whitney Vertical Die Sinker.
No. 1 Cleveland Plain Millers, S.P.D. (2).
24-in. Brown & Sharpe Gear Cutters.
37-in. Baush Vertical Boring Mill.
42-in. Bullard Rapid Pro. Vert. Bor. Mill, M.Dr.
42-in. Bullard Vertical Boring Mill.
13x21-in.x8-ft. Star, Gap Lathe, Belt Driven.
17-in.x6-ft. LeBlond Rapid Prod. Lathes (3).
24-in.x14-ft. Reed-Prentice Grd. Hd. Lathe.
25-in.x12-ft. LeBlond Q. C. G. Lathes (6).
26-in.x14-ft. McCabe Screw Cutting Lathe.
32-in.x20-ft. Rahn Carpenter Engine Lathe.
46-in.x16-ft. New Haven Engine Lathe.
40-lb. Bradley Helve Hammer.
60-lb. Rochester H. D. Helve Hammer.
1,100-lb. N-B-P Steam Forging Hammer.
Miner & Peck Drop Presses, 600 lbs. (4).
4-in., 6-in., 8-in. and 12-in. Pipe Threading Machines.
8-ft. Plate Bending Rolls, Drop End.

Send for our 64-page JUNE Illustrated Stock Booklet of Machinery Bargains

WICKES MACHINERY CO.

F. H. NILES & CO., Inc.
Claremont and West Side Avenues, Jersey City, N. J.

H. F. ALLEN CO.

50 Church St., New York, N. Y.

2½-ft. **Fosdick** late type Radial Drill.
No. 1 **Kempsmith** Plain Miller.
A. B. Becker Vertical Miller with power rotary.
50-in. x 28-ft. center **Putnam** geared head Lathe.
4-spindle **Allen** Ball Bearing Drill.

2—6-ft. **Dreses Radial Drills, S.P.D.** thru gear box, tapping attachment.

1—42-in. practically new **Niles-Bement-Pond Boring Mill,** two swivel heads, self-contained motor drive.

1—48-in. x 12-ft. **Cleveland Open Side Planer,** A.C. motor drive.

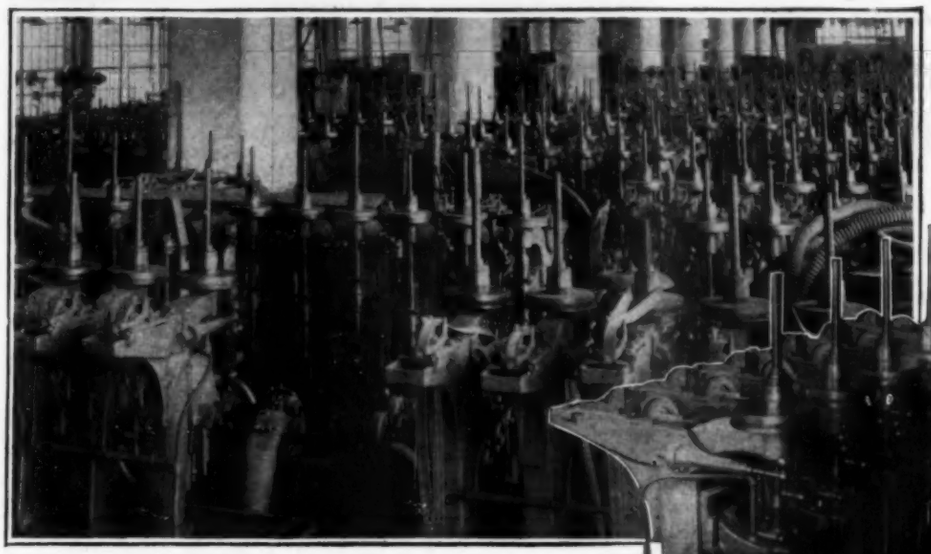
Duff Machinery Corporation
Columbia, Pa., U. S. A.

Bargains in Good Used Machine Tools

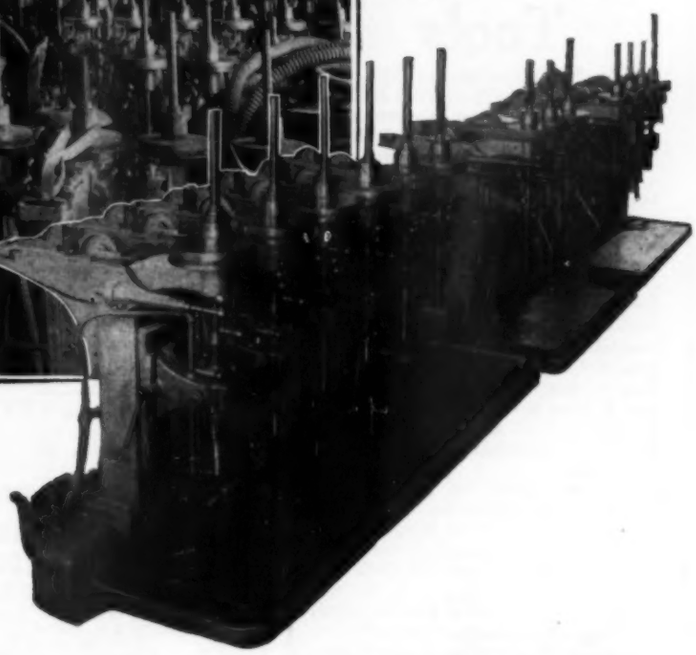
1—Gray Planer, 24x24x6.
1—New Haven Planer, 28x28x8.
1—No. 2 Brown & Sharpe Surface Grinder.
1—No. 14 Brown & Sharpe Plain Grinder.
1—Diamond Knife Grinder.
1—Springfield-Brandes Vertical Grinder, 12x16x84.
1—Gooley & Edlund Milling Machine.
1—F. E. Reed Co. Lincoln Type Milling Machine.
1—No. 3 Garvin Plain Milling Machine.
2—No. 22 Garvin Hand Screw Machines.
1—No. 2½ Garvin Hand Screw Machine Wire Feed B Geared.
1—100 lb. Standard Auto Drop.
1—200 lb. Standard Auto Drop.
1—300 lb. Standard Auto Drop.
2—400 lb. Standard Auto Drops.
1—500 lb. Standard Auto Drop.
1—No. 2 Bliss-Stiles Power Press.
1—No. 3 Bliss-Stiles Power Press.
1—No. 4 Bliss-Stiles Power Press.
1—No. 5 Bliss-Stiles Power Press.
2—Waterbury F. F. & Machine Co. 20 ton Rack and Pinion Press.
1—No. 60½ Bliss Rack and Pinion Press.
1—3x36 Jones & Lamson Turret Lathe, both bar and chucking equipment.
15—Bullard Turret Lathes.
1—18-in. Prentice Chucking Lathe.
3—No. 2 Baird Tilting Tumblers.
1—No. 2 Garvin Horz. Tapping Machine.
1—No. 2 Tilting Tub.
1—Milwaukee 4 Roll Sander 42 in.
1—9x9 West Haven Hack Saw Motor Driven.
1—4 Spindle Taylor & Fenn Drill.
2—14x6 Prentice Geared Head Lathes.
1—18x8 Whitcomb Blaisdell Q. C. G. Lathe.
2—16x6 Prentice Engine Lathes G. C. G. Cone Driven.

THE E. A. EDDY MACHINERY CO., INC.

211 Eddy St., Providence, R. I.



These illustrations are actual unretouched photographs of the drilling machines offered. There are various sizes in from single to six spindle gangs.



Other Equipment Offered in This Big Sale Includes:

LATHES
GRINDERS
SHAPERS
MILLING MACHINES
POLISHING MACHINES
PROFILING MACHINES
SCREW MACHINES
SAWS
SHAVING MACHINES
SPLINE MILLERS
BELT LACERS
BORING MACHINES
THREADING MACHINES
TURNING MACHINES
CHAMBERING MACHINES
LAPPING MACHINES
BARREL LEADING MACHINES
PRESSES
REAMING MACHINES
RIFLING MACHINES
SLITTING MACHINES
SLOTTERS
SPINNING MACHINES
STRAPPING MACHINES
STRAIGHTENING MACHINES
TESTING MACHINES
TUMBLING BARRELS
WHEELWASHING MACHINES

Write for full particulars on any type of machine listed above!

100 DRILLING MACHINES

Pick any one of these and you'll get a bargain!

SURPRISINGLY LOW PRICES

Following our double page announcement last week, this advertisement is the first of a series giving more detailed information on some of the larger quantities of individual types of surplus equipment at the Colts Patent Firearms plant, that must be liquidated immediately! Watch for future advertisements—meanwhile consider these drilling machines.

Every machine has had the best of care in operation and is in condition to stand up to your requirements for many years. With sacrifice prices prevailing, if you need drilling machines, this offering is one of those few and far between opportunities to make a bona fide bargain purchase! Look over this list—come to Hartford and buy!

10—Allen, 3 spindle.
5—Allen, 4 spindle.
4—Allen, 6 spindle.
1—Avey No. 3, 4 spindle.
1—D'Amour, 12 inch.
2—Garvin No. 3, 4 spindle.
1—Garvin, No. 3, 6 spindle.
12—Langelier, 2 spindle.
3—Langelier, 3 spindle.
1—Langelier, 6 spindle.
1—Leland-Gifford, 1 spindle. Bench Drill Press.
7—Pratt & Whitney, No. 11. Multiple Drills.
2—Sigourney, 1 spindle. Drill Press.
41—Pratt & Whitney, No. 1, 2 spindle gun Barrel Drilling Machines with 6-ft. beds.
3—Pratt & Whitney, No. 1, 2 spindle Gun Barrel Drilling Machines with 9½-ft. beds.
1—Colt, cone drilling machine.
1—Dwight Slate, 14 in., 4 spindle, drill press.
1—Dwight Slate, 14 in. 2 spindle drill press.
1—Dwight Slate, 15 in. 3 spindle drill press.
1—Dwight Slate 15 in. 2 spindle drill press.

INSPECTION INVITED—Any of this equipment can be inspected week days between the hours of 8 to 5 and up to 12 o'clock Saturdays or at other hours by appointment. Come and look them over—see for yourself the real values we are offering.

Address all correspondence regarding this Sale to:—

BOTWINIK BROTHERS, Inc.

122 Huyshope Ave., Hartford, Conn.

Guaranteed Used Machine Tools

1—3-in. Bar Lucas Boring Mill.
1—4-in. Bar Detrick-Harvey Mill.
1—24-in. Bullard Vert. Turret Lathe.
1—60-in. Niles Vert. Boring Mill.
1—60-in. Cincinnati Vert. Mill.
1—84-in. Niles Vert. Boring Mill.
1—1-in. Landis Bolt Cutter.
1—2½-in. Landis Bolt Cutter.
1—3-in. Landis Bolt Cutter.
8—Allen 3-spindle Drills.
9—Allen 2-spindle Drills.
2—No. 14 Natco 22 spindles.
2—No. 3 Bausch 40 spindles.
2—Moline Cylinder Boring.
1—6-ft. Cincinnati Bickford Radial.
1—6-ft. American Radial.
1—5A Lees Bradner Hobber. M. D.
4—Norton Tool and Cutter.
1—No. 16 Blanchard Motor Driven Grinder.
14—6x32 to 26x144 in. Norton Plain Cylindrical Grinders.
10—Pratt-Whitney Tool Room Lathes.
3—30 in. x 11 ft. American Grd. Hd.
2—30 in. x 13 ft. American Grd. Hd.
1—36-in. x 60-ft. Bridgeford Boring.
1—42 in. x 18 ft. N-B-P Geared Head.
1—44 in. x 34 ft. Bement Engine Lathe.
1—60 in. x 34 ft. Bement Engine Lathe.
1—72-in. x 56-ft. N.B.P. Motor Drive.
1—72 in. x 34 ft. Bement Engine Lathe
9—5-in. P. & W. Automatic Millers.
2—No. 5 Cincinnati H.P. Plain.
2—No. 4 Cincinnati H.P. Vertical.
1—No. 3 Cincinnati H. P. Vertical
1—No. 2½ Rockford Universal.
1—No. 2½ Le Blond Universal.
2—No. 1½ American Universal.
1—24x24x10 Ingersoll Slab.
1—No. 3 Garvin Duplex, 60-in. feed.
1—No. 2 Van Norman Duplex.
1—No. 3E Lees Bradner Thread.
2—P. & W. Shaving Machines.
1—No. 1 Bliss Toggle Press.
1—55 Ferracute Drawing Press.
1—96-in. Long-Allstatter Multiple Punch, Type C.
2—Hilles-Jones Guillotine Shears.
1—5x5 Alligator Shear.
1—32-in. Smith-Mills Shaper.
1—28-in. Queen City Shaper.
1—24-in. Gould-Eberhardt Shaper.
3—24-in. Cincinnati Shapers.
1—16-in. American Shaper.
1—15-in. Newton Slotter.
1—P. & W. Vertical Shaper, 6 in.
2—00 Brown & Sharpe Automatics.
5—O Brown & Sharpe Automatics.
1—00G Brown & Sharpe Automatic.
4—¾-in. Gridley 4-spindle.
10—2¼ to 4¼ Gridleys S S.
7—18-in. Libby Turret Lathe.
1—No. 3-A Warner-Swasey.
9—2x26-in. P. & W. Turret Lathes.
5—3x36-in. J. & L. Turret Lathes.
2—⅝x4½-in. P. & W. Screw Machines.
1—600-lb. Billings - Spencer Board Drop Hammer.

SIMMONS MACHINE TOOL CORPORATION
1205 Troy Rd., Albany, N. Y.

149 Broadway, New York
84 Exchange St., Buffalo, N.Y.

CHOICE

POWER PRESSES

AT ATTRACTIVE PRICES

1—No. 206 C TOLEDO
DOUBLED CRANK, GEARED,
3-in. STROKE, BED 72-in. by 20-in.
WEIGHT 34,900 LBS.
USED 6 MONTHS

1—No. 661 TOLEDO
150 TON KNUCKLE JOINT
1¼" STROKE
WEIGHT 8,850 LBS.
LIKE NEW

2—No. EG-54 FERRACUTE
400 TON KNUCKLE JOINT
2" STROKE
WEIGHT 16,500 LBS.
EXCELLENT CONDITION

1—No. 666 TOLEDO
1,000 TON KNUCKLE JOINT
TIE ROD, 2¼" STROKE
WEIGHT 90,000 LBS.
USED 18 MONTHS

1—No. DDG-56 FERRACUTE
100 TON CAM DOUBLE ACTION
5" AND 10" STROKES
WEIGHT 15,000 LBS.
FINE CONDITION

1—No. PG 6 FERRACUTE
GEARED, 100 TON PRESSURE
WEIGHT 13,500 LBS.
NEW CONDITION

2—No. 202 BLISS
AUTOMATIC WITH COMBINATION
TRANSFER AND LATERAL FEED
5 DIE SLIDES, 5" STROKE
WITH TIE RODS, GEARED
WEIGHT 8,500 LBS.
PERFECT CONDITION

2—No. 57-S TOLEDO
STRAIGHT SIDE, TIE ROD
4¼" STROKE
WEIGHT 20,000 LBS.
PRACTICALLY NEW

1—No. 59 TOLEDO
S.S. DOUBLE GEARED
4" STROKE
WEIGHT 50,000 LBS.
USED 8 MONTHS

Over 1200 Presses in Stock

DON'T FAIL TO SEND US YOUR INQUIRY

Write for Complete List

Joseph HYMAN and Sons
PRESS SPECIALISTS
RICHMOND ST. AND ERIE AVE.
PHILADELPHIA, PA.
PHONE REGENT 7727

FOR SALE

1—150 Kw., 250 volt, direct connected Ball Engine, complete with G.E. switch board, voltmeter and ammeter.
1—No. 10 Wells Gang Press, 52-in. between housings.
2—Moline Type 9 Multiple Boring Machines.
1—No. 6 Long & Alstatter Double Punching and Shearing Machine.
1—Right Hand Wells Knotting Machine for 10½ to 13½ Gage Wire.
1—Left Hand Wells Knotting Machine for 10½ to 13½ Gage Wire.
2—No. 1½ Wells Improved Auto. Spring Coiler.
2—Wells Bender & Twister, Iron Column Stand.
2—Wells Automatic Crimping and Forming Machine.
1—Wells Auto. Wire Straightener for No. 11 Wire.
1—Power Pipe Bending Machine, 2½-in. Capacity, Direct Connected to 5 HP., G.E., D.C. Motor.
1—Horizontal Geared Tapping and Boring Machine.
1—Hydraulic Press Machine for assembling steel furniture and equipment.

All of this equipment is in good condition and priced low for quick sale.

PURCHASING DEPT.
SMITH & DAVIS MFG. CO.
St. Louis, Mo.

SHAPERS

Smith & Mills 20-in. B. G. Crank	$350
Hendey 24-in. friction	200
Hendey 28-in. friction	200

PLANERS

Walter Bros. 16-in.x16-in.x42-in.	150
Whitcomb Mfg. Co. 17-in.x4-ft.	200
Putnam 22-in.x22-in.x5-ft.	175
Powell 22-in.x22-in.x5ft.	175
Whitcomb-Blais. 24-in.x8-ft., 2 rail hds.	600
Whitcomb-Blais. 30-in.x8-ft., 2 rail hds.	1250
D. W. Pond 36-in.x16-ft., 2 rail hds.	700

MISCELLANEOUS

National-Acme No. 56 auto. screw machine, 2¼-in. capacity	150
Mitts & Merrill No. 5 keyseater, well equipped	600
Bignall & Keeler No. 8 Duplex Pipe Machine	600
Cockburn-Barrow Power Punch, dia. of wheel 54-in., face of wheel 8½-in., depth of throat 24-in.	200
New Doty No. 7-B, Shear, will cut flats 4-in.x½-in., rounds 1¼-in. dia.	65
David Bell & Sons 500 lb. Steam Hammer	150
Canton Fdry. & Mch. Co. No. 2 Alligator Shear	250
Lapointe M. T. Co. No. 1 Broaching Machine	100
Lapoint M. T. Co. No. 3 Broaching Machine	350
Pratt & Whitney two spd. 4-in. centering machine	50

Hill, Clarke & Co., Inc.
The Oldest Exclusive Machine Tool House in the United States.
156 Oliver St., Boston 9, Mass.

EIGHT USED MACHINES EQUAL TO NEW—

Get our low prices on them!

No. 4 Warner & Swasey Universal.
Brand New No. 6 Warner & Swasey.
16-in. G & E Shaper Cone Drive.
24-in. G & E Shaper S.P.D.
6x48 Pratt & Whitney Thread Miller.
No. 4 Cincinnati Vertical Mill.
No. 1½B Milwaukee Vertical Mill.
4-Spindle Demco Drill B.B.

International Machinery Co.
140-142 E. Larned St., Detroit, Mich.

Northern 10-ton Electric Traveling Crane

D. C. Current, 57-ft. span, about 400 feet of track and runway, good condition.
FRANZ TRUCKING & RIGGING CO.
443 East 10th St., New York City.
Lex. 7950-1

FOR SALE

6, 11, 18-in. Gleasons.
3-spindle Gould & Eberhardt Roughers. Good as new.

CROSS GEAR TOOTH ROUNDER CO.
3250 Bellevue Ave., Detroit, Mich.

Sheet Metal Working Tools

1—4-ft. Royerson Power Brake, 14 gauge capacity.
1—8-ft. Royerson Power Brake, 10 gauge capacity.
1—300 Peck, Stow & Wilcox 36-in. Power Shear.
1—Peck, Stow & Wilcox Rotary Shear, 15-in. gap, capacity of cutting 1/16-in. stock.

IDEAL MACHINERY COMPANY
Plainville, Conn., U. S. A.

HENDY LATHES

2—12-in.x4-ft. Geared head with taper attachments arranged for motor drive with motor.

DELTA EQUIPMENT CO.
148 N. Third Street, Philadelphia, Pa.

SPECIAL BARGAINS

	Price Each
17—Foster No. 1 Hand Screw Machines with automatic chucks, bar feeds, collets, tools, C/S., etc.	$150
21—Foster No. 2 Hand Screw Machines with automatic chucks, bar feeds, hand screw cutoffs, power feeds to turrets, collets, tools, C/S., etc.	250
15—Foster No. 3 Hand Screw Machines with automatic chucks, bar feeds, hand screw cutoffs, power feeds to turrets, collets, tools, C/S., etc.	325
11—Foster No. 6 Hand Screw Machines with automatic chucks, bar feeds, hand screw cutoffs, power feeds to turrets, collets, tools, C/S., etc.	550
7—Garvin No. 22½ Duplex Screw Machines with power feeds, etc.	225
10—Taft-Peirce No. 2 Universal Grinders with chucks, dogs, internal attachments, work rests, C/S., etc.	475
5—Heald No. 70 Internal Grinders with countershafts	$475
3—Norton 6x32-in. Plain Cylindrical Grinders with C/S., and equipment	450
10—Hendey No. 2½ Lincoln Type Millers with vises and C/S.	90
15—Briggs Type "A" Production Millers with C/S., arbors, etc.	175
15—Becker No. 7 H Lincoln Type Millers with arbors, and C/S.	125
40—Whitney No. 6 Hand Millers with C/S.	100
5—J. N. LaPointe (New London) No. 3 Double Broaching Machines	450
6—American No. 64 Rotary Heating Machines (Gas Furnaces)	200

These machines are all in good condition. May be inspected here at our warehouse at New Haven. Each machine tested under Belt before shipping. Guaranteed. Terms 1/3 with order, Balance S/D.

BOTWINIK BROS., INC.

NEW HAVEN, CONN.
67 Water St.

"Connecticut Machinery Merchants"

BRIDGEPORT, CONN.
28-42 Drouve St.

SOME BRAND NEW AT REDUCED PRICES—

LATHES (Pratt & Whitney—Walcott, Seneca Falls)
DRILLS, SCREW MACHINES (Get Details and Low Prices)

SCREW MACHINES, ETC.

1—**Libby 18-in. Turret Lathe, "A."**
3—No. 1 **W. & S.**, plain, latest.
3—100% new—reduced prices—**Bardons & Oliver** No. 2—g.f.h., p.f., to t.
1—No. 4 **Bardons & Oliver** g.f.h., etc.
2—No. 1 B. & S. semi-auto.—latest.
1—No. 6 **W. & S.** g.f.h., p.f. to turret.

MILLERS AND SHAPERS

1—No. 2-B **B. & S.** Plain s.p. drive.
1—No. 3 **Hendey** Univ.—cone drive.
20—**Becker, Kempsmith, Hendey** Lincoln Type, No. 7-H, No. 32, No. 4, sizes.
15—**Briggs** type "A" Prod. with 16 in. feeds.
1—**Rhodes**, 7-in., with vertical and rotary att.

GOOD LATHES ONLY

8—Brand New—**Pratt & Whitney Lathes.**
1—16x8 S.P. dr. with taper attach.
1—10x10 cone drive, with taper attach.
6—14x10 cone drive, all latest.
35—**Walcott Q.C. Gear Lathes**—(New), 14 to 29 in. swing, by 6 to 20 ft. long. Send for illustrated circulars. (Bargain prices).
6—**Pratt & Whitney Bench Lathes**, 7x32 in. with thread cutting attachments.

MISCELLANEOUS

5—**Planers—Cincinnati-Whitcomb** makes, 24x6, 24x8 and 26x5 latest.
6—No. 16 **Bliss Horning**—also No. 39.
1—**Drill**—26-in. Rockford Sliding Hd. (new).
4—**Cyl. Grinders** No. 60 Heald—like new.
3—**Grinders**—3x18 Norton, self-cont.
1—**Chucking Grinder**—No. 20 Bryant.
1—**Gear Cutter**—No. 3 B. & S. 26 in.
1—No. 11 **B. & S.** Plain Grinder—6x32in.
10—Inclin. **Presses**—all sizes and makes.
4—**Fox Lathes, Amer.** No. 2 b.g. 18x6.
1—**Thread Miller, P. & W.**, 4½x12-in.
2—**Broachers**, No. 1 and 2 **La Pointe.**
1—**Drill**, 4 sp. **Henry & Wright**, high sp.
1—**Gear Hobber**, Pfauter 39½-in. Max. Spur Dia., Diam. Pitch 2½-in. Max.

PHONE—10465—5355—CANAL

A. LAMBERG & CO., 241-245 Centre St., New York City

A Few From Our Large Stock

1—30-in. Diamond Face Grinder.
4—No. 65 Heald Cylinder Grinders.
1—No. 6 Rivett Internal Grinder.
1—Springfield Rotary Surface Grinder, Table 43-in. dia.
6—No. 6A Potter and Johnston Semi-Automatics.
4—18-in. x 6-ft. Fox Monitor Lathes.
1—25-in. x 10-ft. LeBlond Combination Turret Lathe.
1—2½-ft. Morris Radial Drill.
1—No. 65D-5 Moline Rail Drill.
1—No. 4 Fox Drill, 24 spindles.
4—2-in. Model B Cleveland Automatics.

Complete Stock.
Send us your inquiries.

RIVERSIDE MACHINERY DEPOT
251 St. Aubin Ave., Detroit, Mich.

"Only Good Used Tools"

PLANERS

24x24x6 Cincinnati, 1 head.
26x26x6 Cincinnati, 1 head
30x30x10 Cincinnati, 2 heads.
30x30x18 Cleveland open side, 2 heads, motor drive.

BORING MILLS

34-in. Rogers, geared feed, 3-jaw chuck, motor drive.
42-in. Bullard Rapid Production, 2 swivel heads, motor drive.
No. 3 W. F. & J. Barnes Horizontal.

GEAR CUTTERS

No. 2 Adams Farwell Gear Hobber.
36-in. R. Gould & Eberhardt, vert. type, Spur & Bevel.
36-in. Brown & Sharpe, spur only.

GRINDERS

No. 4 Gardner, 24-in. disc.
No. 23 Baxter Whitney Cylinder.
8-in.x30-in. Modern plain, self contained.
10-in.x72-in. Norton Plain.

LATHES

14-in.x6-ft. Rockford, 3-step, D. B.G., quick change, C.R.
18-in.x6-ft. Sebastian, 3-step, D. B.G., quick change, C.R.
18-in.x10-ft. Boye & Eames, 3-step, D.B.G., quick change, C.R.
22-in.x10-ft. Bradford, 3-step, D.B.G., quick change, C.R.

MILLING MACHINES

No. 0 Owen Plain.
No. 2 Cincinnati Plain.
No. 2½ LeBlond Plain.

DRILLS

No. 3—24-in. Avey, sliding head, P. F.
24-in. Mechanics, sliding head, B. G., P. F.
26-in. W. F. & J. Barnes, sliding head, B. G., P. F.

SHAPERS

20-in. Rockford, back geared.
20-in. Steptoe, back geared.
21-in. American back geared.

MISCELLANEOUS

No. 4-A Etna Swaging Machine.
Ingle Tooth Rounder.
30-in. Throat Collier-Smith Circle Shear, geared.
Napier Band Saw.

Write Us For Full Information.

MARSHALL & HUSCHART MACHINERY CO.
17 So. Jefferson St., Chicago, Ill.

Ogden R. Adams Co., Inc.

Rochester, N. Y.

20-in. Rockford Drill B.G.P.F.
20-in. Barnes Drill B.G.P.F.
20-in. Barnes Drill B.G.P.F.T.A.
20-in. Barnes Drill W. & L.
20-in. Royersford Drill B.G.P.F.
20-in. Davis Drill B.G.P.F.
15-in. Barnes Friction Drill.
Taylor & Fenn Type "C" Drill.
No. 2 Avey Single Spindle Drill.
42-in.x20-ft. Bridgeford Lathe.
20-in.x8-ft. American Geared Head Lathe.
18-in.x8-ft. Prentiss Lathe.
16x10 Champion Lathe.
16x8 Davis Lathe.
14x6 American Geared Lathe.
14x6 Wolcott Lathe.
14x6 Sidney Lathe.
No. 20 American Saw Table.
Pettingell Tenoner.
Cordeman Saw Table.
No. 2 Clement Saw Table.
6-in. Rowly & Herman Sticker.
American 2-spindle shaper.

SPECIALS

No. 0 B&S Wire Feed Screw Machines (7).
No. 2-F B&S Constant Speed Hand Screw Machine.
No. 6 B&S G. F. H. Chucking Machines.
No. 11 B&S Plain Grinders, 4x30.
No. 10 B&S Plain Grinders, 6x20.
No. 12 B&S Plain Grinders, 8x30.
No. 3 B&S Gear Cutter, 26x8.
No. 4 B&S Gear Cutter, 36x9.
No. 3 HEAVY B&S Automatic Gear Cutter, 24x8.
No. 2 B&S Plain Milling Machine.
No. 2 HEAVY B&S Plain Milling Machine.
No. 3 B&S Plain Milling Machine.
Model "C" Becker High Power Vertical Miller.
No. 2 B&S Vertical Miller.
5 ft. Prentice Plain Radial Drill.
15 in. Potter & Johnston Shaper.
48x72x20 ft. Gray Planer, 4 heads.
No. 2 Lapointe Broaching Machine.
12 in. Bement Miles Slotter.
60 in. x 14 ft. Putnam Engine Lathe.

Brownell Machinery Co.
150 Pine St., Providence, R. I.

AUTOMATICS

1—Gridley Late Type, 7/8-in. cap. Serial No. 8124.
1—B. & S. 00. Serial No. 7014.
1—B. & S. No. 2 Semi Auto. Single Step. Lot of extra collets. Very cheap.
1—Foster Hand Screw Machine, 1-in. capacity.

All these machines equal to new. Will sell at reasonable prices.

NAHAM TOOL & SUPPLY CO.
199 Centre St., New York City

Boring Mills, 34 in. and 54 in. Colburn.
Drills, Bench, Avey No. 1 and Leland-Gifford.
Drills, 1, 2, 3, 4 and 6 Spindle Sensitive.
Grinder, Universal, 16x42 Landis.
Grinders, Surface, Wilmarth & Morman No. 1 and 78.
Hammer, 40 Pound Bradley Helve.
Lathe, Monarch 14x6 and 16x6.
Lathe, American 18x10 quick change.
Lathe, Turret, No. 4 Woods Tilted.
Lathe, 14-in.x8-ft. Young Lathe.
Lathe, 24-in.x24-ft. Prentice, raising block.
Miller, Plain, No. 25 Becker.
Milling machine, B. & S. No. 2 heavy plain.
Oil Separator, Springfield.
Planer, 36x36x12 Gray, four heads.
Planer, 24x24x6-ft. Fitchburg.
Presses, No. 3-A Willard and No. 1, 1½ and 2 Robinson.
Punch & Shear, ¼x½ style L-10.
Radial Drill, 3¼-ft. Silver, new.
Shear, 5 ft. for 10 gauge metal.
New 3 Phase Motors, 5 Hp. $67.50; 3 Hp. $57.50.

THE OSBORNE & SEXTON MACHY. CO.
Columbus, Ohio

No. 33 New Britain
Automatic Chucking Machine

No. 2 Standard
200 Automatic Drop Hammers

Both of the above in excellent condition ready for prompt shipment.

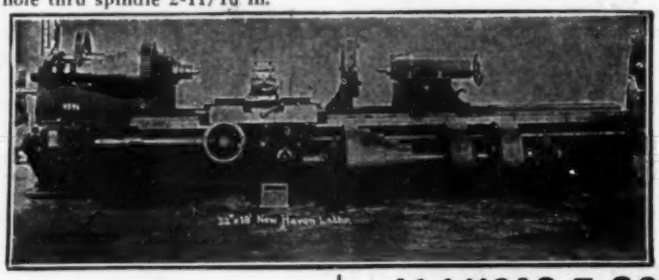
J. N. MOYER
117 N. 3rd St., Philadelphia, Pa.

$300. Worth Saving?

That's exactly what we've chopped from our list price on this lathe for quick sale. It is fully 95% new

32 in. x 18 ft. New Haven Lathe

Back geared, compound rest, semi-quick change. Between centers 10½ ft.; hole thru spindle 2-11/16 in.



Send for photo and full description

Special Price $1500

J. L. LUCAS & SON Inc
LUCAS MACHINERY SERVICE
BRIDGEPORT, CONN.

TIME CLOCKS-LOCKERS STORAGE CABINETS

STEEL PARTS BOXES — STEEL SHELVING

(New Bargains)

International Time Recording Time Clocks, Style 1116. Cost $292. Our price $125. Two-color, automatic. Out of town shipments $10 additional for crating.
Steel Clothes Lockers, hat shelf, hooks, 3-way lock, all sizes, attractive prices.
Double Door Steel Storage Cabinets, 36x18x78 adjustable shelves, lock and keys. Each $29.75 f.o.b. cars Aurora, Ill.

Send for our Bargain Catalog.

NEW YORK MACHINERY CO.,
Dept. A.M., 200 5th Ave., N. Y. C.

FOR SALE

MACHINE TOOLS

1—24-in.x24-ft. Fifield Lathe, belt drive.
1—2¼-in. Milholland Screw Machine, belt drive.
1—25-in. Sliding Head Mechanic Drill Press, belt drive.
1—36-in. Sliding Head Reed Prentice Drill Press, belt drive.
1—38-in. Sliding Head New Haven Drill Press, belt drive.
1—20-in. Barnes Drill Press, belt drive.

Subject to Prior Sale and Inspection. For further information address

The American Ship Building Co.
Cleveland, Ohio

No. 408A BLISS

DOUBLE CRANK TOGGLE

72 in. between uprights tie rod. Strokes 10 in. and 15 in.
Weight 114,000 lbs. Used less than two months.

LOW PRICE—IMMEDIATE SHIPMENT

JOSEPH HYMAN AND SONS
Richmond St. and Erie Ave., Philadelphia, Pa. Phone Regent 7728

FOR SALE

UNIVERSAL ROCKFORD MILLING MACHINE

1—No. 2 Heavy Duty. Never Used.
Price $1100.

Special Machine Tool Engineering Works
203-205 Lafayette Street, New York City

"Opportunity" Advertising:

Think "SEARCHLIGHT" First!

G-24

"SEARCHLIGHT"

Opportunity Advertising

—to help you get what you want.

—to help you sell what you no longer need.

Take advantage of it — For Every Business Want

"Think SEARCHLIGHT First"

0165

ENGINE LATHES

14-in.x6-ft. LeBlond, l. c. g. and chuck.
14-in.x6-ft. Hamilton.
14-in.x6-ft. American, c. r. and t. a.
14-in.x6-ft. Porter, c. r. and t. a., l. c. g.
14-in.x8-ft. Monarch, c. r., stand. pattern.
16-in.x6-ft. South Bend, c. r., complete.
16-in.x8-ft. Lodge & Shipley, old style, c. r., q. c. g.
18-in.x8-ft. Prentice, c. r., l. c. g., chuck.
18-in.x8-ft. American, 3-step cone, d. b. g., q. c. g.
18-in.x8-ft. Schumacher-Boye & Emmes, c. r., 3-step cone, s. b. g., q. c. g.
18-in.x10-ft. Star, 4-s. c., s. g., with 16-in. 4-jaw ind. chuck.
24-in.x12-ft. Lodge & Shipley, patent hd., compound rest, q. c. g., arranged for constant speed motor dr.
27-in.x12-ft. Lodge & Shipley, patent hd., compound rest, q. c. g., arranged for constant speed motor dr.

TURRET LATHES AND SCREW MACHINES

No. 2-A W. & S. g. h. tur. lathes.
No. 4 W. & S. g. f. h. universal turret screw machine.
26-in. Gisholt heavy duty turret lathe.
2-in.x24-ft. Jones & L. g. h. flat turret.
No. 00 Brown & Sharpe auto., (3).
No. 0 Brown & Sharpe auto. (2.)
No. 4 W. & S., p. h., a. c. & b. f.
No. 2 W. & S., p. h, a c. and b. f.
No. 4 Warner & S., g. f. h., a. c. and b. f.
No. 3 Foster g. f. h. turret screw mch, with p. f. carriage and turret.
No. 55 Nat'l Acme 4-spdl. auto., (3).
2¼-in. Cleveland model "A" auto, screw mch., with 5-hole turret.
1¼-in. Cleveland model "A" auto, screw mch., with 5-hole turret.
No. 6 W. & S. g. f. h. screw mach., with p. f. turret.
18-in. Libby, factory rebuilt.
No. 2-G B. & S. automatics (2).
No. 2 B. & S. turret forming (2).

DRILLING MACHINES

22½-in. Cincinnati, sliding head, friction back geared, power feed.
24-in. W. F. & J. Barnes, sliding head, back geared and power feed.
26-in. Aurora, slid. hd., b. g. and p. f.
2-ft. arm Fosdick & Holloway plain radial, with t. a.
34-in. Baker heavy duty.
No. 2-D Minster heavy duty, with compound table.
7-in. No. 1 Allen sgl. spdl. ball h. (3).
14-in. 4-sp. Leland-G., h. s., b. b. (2).
14-in. 3-spdl. Henry & W., h. s., b. b.
14-in. 4-spdl. Henry & W., h. s., b. b.

MILLING MACHINES

No. 0 Bickett, hand, bench type (3).
Toledo hand milling machines.
No. 13-B B. & S. mfg. type, (2).
No. 1-B K. & T. "Milwaukee" pl., constant speed dr.
No. 1 Brown & Sharpe vertical.
No. 22 Garvin vertical, with circular milling attach.
No. 1-Y Brown & Sharpe plain.

GRINDERS

No. 1 B. & S. universal.
No. 3 B. & S. universal.
No. 2 B. & S. surface, (2).
No. 10 B. & S. plain.
No. 6-A Bryant internal.
No. 1 LeBlond cutter grinder.
Type "DE" Hisey-Wolf internal.
No. 11 B. & S. plain grinders.
Plain emery wheel stand with column.

SHAPERS AND PLANERS

16-in. Hendey friction, (2).
22-in.x22-in.x5-ft. Putnam planers (2).

METAL CUTTING TOOLS AND SQUARING SHEARS

Higley cold saw.
3-in. new Davis cutting-off machine.

GEAR CUTTERS AND HOBBERS

26-in. and 36-in. No. 3 Brown & Sharpe auto.
No. 18 G. & E. vert., for spur and spiral.
No. 13 Brown & Sharpe auto.
No. 12 B. & S., bevel.

MISCELLANEOUS

Boring mill, 54-in. Bullard vertical, 2 swivel hds., rapid traverse, arranged for belted motor dr.
Centering mchs., sgl. sp. Cadillac, (2).
Cock grinder, 4-spindle No. 2 Turner automatic.
Hammer, Quick work body hammer.
Tapper, No. 2-X Garvin vertical.

The Strong, Carlisle & Hammond Co.
1392 West Third St., Cleveland, Ohio — 1300 West Fort St., Detroit, Mich.

Natco Multiple Spindle Drill

No. 14. Twenty-two spindles. Tapping attachment. Two speed type. 34-in. Rotating table. Excellent condition.

Riverside Machinery Depot
251 St. Aubin Avenue, Detroit, Michigan.

PRICES RIGHT

Automatics, No. 0, 00, 2G Brown & Sharpe.
Automatics, 2 No. 52 Nat'l Acme.
Automatics, 1⅝x7 in. New Britain.
Boring Mill, 24 in. New Era Type.
Boring Mill, 30 in. Bullard.
Chuck, Heald Rotary Magnetic.
Gear Shaper, Fellows No. 6, 62, 612 and No. 65 Helical.
Grinders, 8—20 in. Besley, press blower, 6 discs.
Grinder, No. 11 Brown & Sharpe.
Lathe, 9x14 in. Porter-Cable.
Lathe, turret, 3x36 J & L.
Lathe, turret, No. 4 W & S.
Millers, 2 new 5 in. Automatic P & W.
Press, No. 4 Stiles-Bliss, geared.

D. R. CLARKSON
Rochester, N. Y.

Lot More Useful Hours

No. 37—14 sp. Natco Drill with 14x26-in. rectangular 3-speed head.

6-ft. Fosdick Radial Drill, single pulley drive; thru C/S tapping attachment.

No. 5—48x10-in. B & S Auto. Gear Cutter, spur gears only.

No. 4 Landis Univ. Grinder, lot of attachments, good shape.

1100-lb. Bement Sgle. Frame Steam Hammer, with anvil.

36 in. x 36 in. x 14 ft. Ohio Planer, 2 heads on cross rail.

THE E. L. ESSLEY · MACHINERY · CO
551 W. Washington Blvd.
Chicago, Ill.

GUARANTEED TOOLS

REAL BARGAINS

Automatics, 1¾-in. & 2¼-in. Gridley, 4 spdl.
Brake, 8-ft.x14 ga. Dreis & Krump, New.
Centerer, 7-in. Whiton, 2 spdl.
Centers, Planer, 30-in. Newton.
Chuck, 18-in. Union, 4 jaw comb.
Compressor, 8x8-in. Ingersoll "ER-2."
Crane, 2 ton, 20-ft. arm jib.
Die Head, 4-in. Landis.
Drill, Upright, 25-in. Snyder.
Drill, Radial, 4-ft. Mueller.
Drill, Multiple, 12 spdl. Natco No. 30.
Drill, Sensitive, 8-in. Henry & Wright.
Furnace, Stewart No. 10.
Grinder, 10x36-in. Norton.
Grinder, Internal, No. 70 Heald.
Grinder, Face, 84-in. Diamond.
Grinder, Surface, No. 2 Brown & Sharpe.
Gear Hobber, 12-in., 18-in. and 24-in. G & E.
Gear Cutter, 26-in., 36-in. and 48-in. B&S.
Hoist, 3 ton Northern Electric, AC.
Hammer, 1,100 lb. Bement Miles, steam.
Lathe, Engine, 20-in.x8-ft. American.
Lathe, Turret, No. 2-A Warner & Swasey.
Lathe, Stub, Sundstrand.
Mill, Vertical, 53-in. Niles Bement Pond.
Mill, Horizontal, 3-in. bar Lucas.
Miller, Plain, No. 2-BS. 2B & 3B Milwaukee.
Miller, Univ., No. 2 and 3 Kempsmith.
Miller, Vertical, No. 4 Cincinnati.
Press, No. 3 Loshbough Jordan OBI.
Pipe Machine, 6-in. Williams.
Shaper, 24-in. Gould & Eberhardt.
Threader, 2½-in. Landis.
Welder, ARC, 150 amp. Wilson.

MILES
MACHINERY COMPANY
SAGINAW, W.S.
MICHIGAN

Real Bargains
Some Brand New

LATHES

14"x6' Worcester Semi Q.C. New.
16"x8' Morris Q.C. New.
16"x8' Morris, Geared Head. New.
18"x8' Morris Q.C. New.
18"x10' Morris Q.C. New.
20"x12' Le Blond, Single B.G.
21"x8' Le Blond H.D., 220 v., D.C.
22"x10' Morris, Geared Head. New.
22"x12' Morris Q.C. New.
26"x16' Davis, Single B.G.
30"x14' Niles, Single B.G., Cone.
32"x17' Pond Single B.G., Cone.
36"x18' Niles Single B.G., Cone

PLANERS

30"x30"x8' N.B.P. 2 Heads, Rev. Motor.
32"x32"x10' Niles, 2 Heads.
32"x32"x12' Pond, 2 Hds., Motor.
36"x36"x10' Niles, 4 Heads.
38"x38"x12' Niles, 2 Heads.
38"x38"x16' Niles, 3 Heads.
42"x42"x12' Niles, 4 Heads.
42"x42"x14' Pond, 3 Heads.
42"x42"x14' Pond, 4 Heads, Motor.
48"x48"x16' Pond, 4 Heads.
48"x48"x20' Pond, 4 Heads, M.D.
60"x60"x14' Pond, 4 Heads, Motor.
96"x72"x42' N.B.P. Rev. Motor.
10'x10'x36' Belts, Motor.
36"x36"x10' N. B.P. Frog and Switch. Rev. Motor.

SHAPERS AND SLOTTERS

16" S. G. Stockbridge. New.
16" B. G. Stockbridge. New.
20" B. G. Stockbridge. New.
26" B. G. Niles Acme. New.
26" Gear Box Stockbridge. New.
26" Bement Double Traveling Head, Motor.
15" Bement Slotter, 220 v. D.C.
19" Putnam Slotter, Belt D.

RADIALS

5' Niles Universal Gear Box.
5' Niles Semi. Univ. Gear Box.
6' Niles Semi. Univ. Gear Box.
6' Niles Full Univ. Gear Box.
6' Niles Universal Motor.

BORING MACHINES

60"-4" Bar Niles Horiz. B & D Machine.
3½" Ridgway Horiz. Floor B & D Machine.
5" Bar Niles Floor Borer.
18" P. & W. Side Head Mill.
42" Niles Vert. B. & T. Mill.
44" Niles, R. H. Turret Head, 220 v. D.C.
53" Niles Vert. B. & T. Mill.
62" Niles Vert. B. & T. Mill.
73" Niles Vert. B. & T. Mill.

CRANE, PUNCHES AND SHEARS, AND MISCELLANEOUS EQUIPMENT

25-Ton Niles 115' Span, 4-Motor Yard Crane and 610' Runway.
¾" Cap. L. & A. Plate Shear Motor.
1"x1" Cap. 48" L. & A. P. and S. Motor.
⅞"x⅞" Cap. 12" Throat L. & A. Horiz. Punch.
185 lb. Motor Driven Air Hammer.
800 lb. Bement Single Frame Hone.
800 lb. Bement Board Drop.
No. 2 Mitts & Merrill Keyseater.
No. 3-B J. N. Lapointe Broach.
48" B. & S. Spur Gear Cutter.
2" Cox Lever Grip Pipe Mach. D. C. Motor.
48"x48"x14' Bement Horiz. Slab Miller, 220 v. D.C.
No. 4-B Ver. Miller, Rotary, Becker.

NILES TOOL WORKS CO.
Division Niles-Bement-Pond Co.
HAMILTON, OHIO

New York, 111 Bway.
Birmingham, Brown-Marks Bldg.
Boston, 125 Purchase St.
Chicago, 33 S. Jefferson St.
Cincinnati, 338 W. 4th. St.
Cleveland, 1432 E. 12th St.
Detroit, 5935 Cass Ave.
Los Angeles, 454 E. 3d. St.
Philadelphia, 2415 Chestnut St.
Pittsburgh, 115 Empire Bldg.
Rochester, 89 E. Ave.
St. Louis, 516 N. 3d. St.
San Francisco, 917 Howard St.
John Bertram & Sons Co. Dundas, Ont., Can.
London, Eng., 25 Victoria St., S.W.

Contract Work

ASSEMBLING FACILITIES

This photo showing our assembling department gives an idea of the excellent appointments we offer the customer seeking to place special machines in quantity with outside contractors.

Expert in the Invention—Design—Production of Automatic Machinery—Special Equipment—Modern Plant Fully Equipped—Skilled Mechanics

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD, CONN.

When in need of

Quality Screw Machine Products

Hardened and Ground Parts
Light Forgings

on a Production Basis

We solicit your prints for estimate.

Willys-Morrow Co., Inc.
Drawer A, Elmira, N. Y.

Designers and Builders of

SPECIAL MACHINERY

Machines and Parts built in Quantities. Production Tools Designed and made for interchangeable manufacturing.

Your work will have the general supervision of the management, who are practical mechanics.

Send Us Samples or Blue Prints for Estimates

LIBERTY TOOL AND GAGE WORKS
WOONSOCKET, R. I.

DIES—JIGS—FIXTURES
Special Machinery
The COLUMBUS
Die Tool & Machine Company
Columbus, Ohio.

DESIGNERS AND BUILDERS OF SPECIAL MACHINERY.
PARTS MANUFACTURED IN QUANTITIES.

LINCOLN MACHINE COMPANY
PAWTUCKET, R. I.

MANUFACTURING

We have excellent machine-shop facilities for manufacturing purposes of all kinds. Ask for quotations.

SPRAGUE CORPORATION
421 Canal Street, New York, N. Y.

Machine Work Wanted
Franklin Machine Company
Engineers Founders Machinists
Providence, R. I.

Corliss Steam Engines, Textile Machinery
Special Machinery of all kinds

H.P.PREIS & CO.INC.
NEWARK, N.J.

ENGRAVING MACHINES

BUILT TO MEET YOUR REQUIREMENTS

HART

A Personally Conducted Contract Shop—

The executive management of this modern daylight shop is vested in the three members of one family, who started 30 years ago (in the business of) building

Special Machinery—Dies—Tools—Fixtures

This service includes designing and development work, as well as the complete fabrication and assembly of interchangeable parts.

In Business 30 Years

We welcome the opportunity to show what we can do for you, in terms of what we are now doing for others.

Prices and full details gladly furnished upon request.

FREDERICK HART & CO., Inc.
POUGHKEEPSIE, N. Y.

Established 1895 *Incorporated 1913*

TRADE MEHL MADE MARK

HIGH-GRADE

Jigs, Fixtures, Dies, Gauges and Special Machines

Send for free illustrated prospectus

MEHL MACHINE TOOL & DIE CO.
ROSELLE, N. J.
Established 1913
Thirty Minutes from New York City

CONTRACT WORK ON SMALL PARTS

Complete equipment of modern machined tools with trained force of skilled mechanics insure prompt deliveries at moderate prices on all types of small interchangeable parts.

Prices and full particulars cheerfully furnished on receipt of prints or specifications.

CHOWNING REGULATOR CORP. CORNING NEW YORK

LET US DO YOUR

Heat Treating

WE heat treat pieces from the smallest bolt to parts, weighing several tons.

Why bother with heat treating problems? Our metallurgists will advise you, if you put your problems up to us.

The Lakeside Steel Improvement Company
5418 Lakeside Ave., Cleveland, O.

METAL STAMPING **WIRE FORMING** **METAL DRAWING**

Thirty-five years specialization in this line is your assurance of lowest prices and prompt delivery on the widest range of this work. Plating and Enameling also. In addition we are prepared to assemble and ship complete units made of steel, brass, aluminum and tin plate, etc.

Prices promptly furnished upon receipt of specifications, or better still, come and see us.

ATLAS MFG. CO., 125 Water St., New Haven, Conn.
Manufacturers for over 35 years

WE SPECIALIZE

on tools that incorporate the Five Fundamental Tool Virtues. As a result we offer to make for you:

Tools that are time saving.
Tools that are foolproof.
Tools that are easy to manipulate.
Tools that will give largest possible production.
Tools that will give absolute interchangeability.

Send us your blueprints and specifications. We specialize in difficult toolwork such as the average toolroom has difficulty in handling. Will gladly furnish estimate and will make prompt delivery.

ARTHUR BROCK TOOL & MFG. WORKS, Inc.
533 North 11th Street, Philadelphia, Pa.
U. S. A.

SPECIAL MACHINES AND MANUFACTURING

We build SPECIAL MACHINERY to specifications

WRITE US

THE THOMPSON GRINDER CO., SPRINGFIELD, O.

SPECIAL MACHINERY BUILT TO ORDER

We have splendid facilities for producing special machinery of all kinds, and are prepared to guarantee satisfaction—both as regards workmanship and price. We have foundry facilities and an up-to-date machine shop. Send us blue-prints and give us an opportunity to quote you price. We can save you money.

Lambert & Todd Machine Co., Camden, N. J.

IF YOU HAVE WORK TO GIVE OUT, WRITE TO THE CONCERNS IN THE CONTRACT WORK SECTION.

KELLER AUTOMATIC MACHINES

CUT DIES TIME COST

KELLER MECHANICAL ENGINEERING CORP.
76 WASHINGTON ST. BROOKLYN, N.Y. KMC

WHAT AND WHERE TO BUY

A Classified Index of Advertisers in This Issue

For Alphabetical Index See Last Page

Abrasive Discs
Besly & Co., Chas. H., Chicago
Carborundum Co., Niagara Falls, N. Y.

Abrasive Materials
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.

Accumulators, Hydraulic
Prest-O-Lite Co., N. Y.
Watson-Stillman Co., N. Y.

Air Lifts
Sullivan Machinery Co., Chicago

Angle Plates
Boston (Mass.) Scale & Machine Co.

Arbors
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co
Cleveland (O.) Twist Drill Co.
Cochrane-Bly Co., Rochester, N. Y.
Cushman Chuck Co., Hartford
McCrosky Tool Corp., Meadville, Pa.
Nicholson & Co., W. H., Wilkes-Barre
Rockford (Ill.) Milling Co.
Union Mfg. Co., New Britain
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford

Babbitt
Magnolia Metal Co., N. Y.
United American Metals Corp., Brooklyn

Balancing Machines
Gisholt Machine Co., Madison, Wis.
Rockford (Ill.) Tool Co.

Balancing Ways
Anderson Bros. Mfg. Co., Rockford
Rockford (Ill.) Tool Co.

Ball Retainers
Bearings Co. of America, Lancaster
Fafnir Bearing Co., New Britain
New Departure Mfg. Co., Bristol

Balls, Brass, Bronze and Steel
Abbott Ball Co., Hartford
Auburn Ball Bearing Co., Rochester
New Departure Mfg. Co., Bristol

Balls, Burnishing
Hartford (Conn.) Ball & Rivet Co.

Barrells, Tumbling
Abbott Ball Co., Hartford

Bars, Boring
Cleveland (O.) Twist Drill Co.
Davis Boring Tool Co., St. Louis
Underwood Corp., H. B., Phila.

Bars, Boring, Expansion
Davis Boring Tool Co., St. Louis

Bars, Phosphor Bronze, Cored and Solid
Bunting Brass & Bronze Co., Toledo

Bearing Metals
Bunting Brass & Bronze Co., Toledo
General Die Casting Co., Reading
Magnolia Metal Co., N. Y.
Specialty Brass Co., Kenosha, Wisc.

Bearings, Ball
Auburn Ball Bearing Co., Rochester
Bearings Co. of America, Lancaster
Ex-Cell-O Tool & Mfg. Co., Detroit
Fafnir Bearing Co., New Britain
Norma-Hoffman Bearing Corp., Stamford, Conn.
New Departure Mfg. Co., Bristol
Schatz Mfg. Co., Poughkeepsie, N. Y.
Strom Ball Bearing Mfg. Co., Chicago
Torrington (Conn.) Co.

Bearings, Bronze and Babbitt
Bunting Brass & Bronze Co., Toledo
Franklin Die Casting Corp., Syracuse
Magnolia Metal Co., N. Y.
United Amercian Metals Corp., Brooklyn

Bearings, Die Cast
Light Mfg. & Fdry. Co., Pottstown, Pa.

Bearings, Journal
Bunting Brass & Bronze Co., Toledo

Bearings, Roller
Norma-Hoffman Bearing Corp., Stamford, Conn.
Timken Roller Bearing Co., Canton, O.

Bearings, Thrust
Timken Roller Bearing Co., Canton, O.

Belt Cement
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Clamps
Hoggson & Pettis Mfg. Co. New Haven

Belt Dressing and Fillers
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
Bristol Co., Waterbury

Belt Lacing
Graton & Knight Mfg. Co., Worcester, Mass.
Rhoads & Sons, J. E., Phila.

Belt Shifters
Haskins Co., R. G., Chicago
LeBlond Mach. Tool Co., Cincinnati

Belt Tighteners
Jones Fdry. & Machine Co., W. A., Chicago

Belting, Chain
Boston Gear Wks. Sales Co., Quincy, Mass.
Link-Belt Co., Chicago
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Albany
Whitney Mfg. Co., Hartford

Belting, Leather
Graton & Knight Mfg. Co., Worcester, Mass.
Rhoads & Sons, J. E., Phila.

Bench Legs
Brown & Sharpe Mfg. Co., Providence
Manufacturing Equipment & Engr. Co., Framingham, Mass.
Standard Pressed Steel Co., Phila.

Bending and Straightening Mchs.
Cons. Mach. Tool Corp., Rochester
Elmes Eng. Wks., Chas. F., Chicago
Niles Tool Works Co., N. Y.

Bending Machines, Power
Ryerson & Son, Jos. T., Chicago
Wickes Bros., Saginaw, Mich.

Blocks, Chain (See Hoists, Hand)

Blocks, Pillow
Fafnir Bearing Co., New Britain
Jones Fdry. & Machine Co., W. A., Chicago
Standard Pressed Steel Co., Phila.

Blowers
American Gas Furnace Co., Elizabeth
Buffalo (N. Y.) Forge Co.
General Electric Co., Schenectady

Blue Printing Machinery
Wickes Bros., Saginaw

Bolt and Nut Machinery
Acme Mchy. Co., Cleveland
Foote-Burt Co., Cleveland
Greenfield (Mass.) Tap & Die Corp
Landis Machine Co., Waynesboro
National Machinery Co., Tiffin
Pawtucket (R. I.) Mfg. Co.

Bolt Threading Machinery
Landis Mach. Co., Waynesboro

Bolts and Nuts
National Acme Co., Cleveland
Pawtucket (R. I.) Mfg. Co.

Books, Technical
McGraw-Hill Book Co., N. Y.

Boring and Turning Mills, Vertical
Bullard Mach. Tool Co., Bridgeport
Cincinnati (O.) Planer Co.
Cons. Mach. Tool Corp., Rochester
Gisholt Mach. Co., Madison, Wis.
Sellers & Co., Wm., Philadelphia

Boring, Drilling and Milling Machines, Horizontal
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cons. Mach. Tool Corp., Rochester
Landis Tool Co., Waynesboro
Lucas Machine Tool Co., Cleveland
Moline (Ill.) Tool Co.
Murchey Mach. & Tool Co., Detroit
Niles Tool Works Co., N. Y.
Rockford (Ill.) Drilling Machine Co.
Ryerson & Son, Jos. T., Chicago
Sellers & Co., Wm., Philadelphia
Springfield (O.) Mach. Tool Co.
Universal Boring Mach. Co., Hudson, Mass.

Boring, Drilling and Milling Mach., Vertical
Consolidated Machine Tool Corp., Rochester
Knight Mchy. Co., W. B., St. Louis

Boring Heads
Casler, Herman, Canasota, N. Y.
Davis Boring Tool Co., St. Louis
Waterston, J. M., Detroit

Boring Tools
Armstrong Bros. Tool Co., Chicago
Davis Boring Tool Co., St. Louis

Boring & Turning Mills, Vertical
Niles Tool Works Co., N. Y.

Boxes, Tote (See Furniture, Machine Shop)

Brackets, Lamp Adjustable
McCrosky Tool Corp., Meadville, Pa.

Brake Lining
Raybestos Co., Bridgeport

Broaches
Lapointe Co., J. N., New London
LaPointe Mach. Tool Co., Hudson, Mass.

Broaching Machines
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson, Mass.
Oilgear Co., Milwaukee
Pawtucket (R. I.) Mfg. Co.

Bronze
Bunting Brass & Bronze Co., Toledo
Phosphor Bronze Smelting Co., Philadelphia
United American Metals Corp., Brooklyn

Bronze, Phosphor
Bunting Brass & Bronze Co., Toledo
Phosphor Bronze Smelting Co., Phila.

Bucket Carriers, Pivoted
Link-Belt Co., Chicago

Buckets, Grab
Link-Belt Co., Chicago

Buffing or Polishing Machines (See Polishing and Buffing Machines)

Burners, Oil and Gas
Johnson Gas Appliance Co., Cedar Rapids, Iowa

Bushings
Acme Industrial Co., Chicago
Bunting Brass & Bronze Co., Toledo
Danly Machine Specialties, Inc., Chicago
Ex-Cell-O Tool & Mfg. Co., Detroit
Phosphor Bronze Smelting Co., Philadelphia
Specialty Brass Co., Kenosha, Wisc.
Standard Pressed Steel Co., Phila.
United American Metals Corp., Brooklyn

Cabinets, Tool, Reamer and Drill Steel (See Furniture, Machine Shop)

Calipers
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham, Mass.
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.

Cam Cutting Machines
Rowbottom Machine Co., Waterbury

Cams
Kent Owens Mach. Co., Toledo
Rowbottom Machine Co., Waterbury

Can-Making Machinery (See Sheet Metal Working Machinery)

Carbonizing Machines
American Gas Furnace Co., Elizabeth

Case Hardening and Tempering Compounds
Meisel Press Mfg. Co., Boston
Store Instrument & Mfg. Co., Jamaica, N. Y.

Castings, Aluminum
Bunting Brass & Bronze Co., Toledo
Franklin Die Casting Corp., Syracuse
Light Mfg. & Fdry. Co., Pottstown, Pa.
Stewart Mfg. Co., Chicago

Castings, Brass, Bronze and Copper
Bunting Brass & Bronze Co., Toledo
Imperial Brass Mfg. Co., Chicago
Light Mfg. & Fdry. Co., Pottstown, Pa.
Phosphor Bronze Smelting Co., Phila.
Stewart Mfg. Co., Chicago

Castings, Die Molded
Franklin Die Cast. Corp., Syracuse
General Die Casting Co., Reading
Light Mfg. & Fdry. Co., Pottstown, Pa.
Soss Mfg. Co., Brooklyn
Stewart Mfg. Co., Chicago

Castings, Iron and Steel
American Eng. Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence
Etna Machine Co., Toledo
Franklin Mach. Co., Providence
Link-Belt Co., Chicago
Pangborn Corp., Hagerstown, Md.
Springfield (O.) Mach. Tool Co.

Centering Machines
Hendey Mach. Co., Torrington, Conn.
Pratt & Whitney Co., Hartford
Rockford (Ill.) Milling Mach. Co.
Whiton Mch. Co., D. E., New London

Centers, Lathe
Precision Gauge & Tool Co., Detroit

Centers, Planer
Cincinnati (O.) Planer Co.

Chains (See Sprockets and Chains)

Chains, Driving
Boston Gear Wks. Sales Co., Quincy, Mass.
Grant Gear Wks., Inc., Boston
Link-Belt Co., Chicago
Morse Chain Co., Ithaca, N. Y.
Philadelphia (Pa.) Gear Works
Ramsey Chain Co., Albany
Whitney Mfg. Co., Hartford

Chamfering Mchs., Automatic
Grant Mfg. & Mch. Co., Bridgeport

Chucking Machines
Brown & Sharpe Mfg. Co., Providence
Bullard Mach. Tool Co., Bridgeport
Goss & De Leeuw Mach. Co., New Britain
Jones & Lamson Mach. Co., Springfield, Vt.
Potter & Johnston Mch. Co., Pawtucket

Chucks, Automatic and Quick Changing
Errington Mech. Laboratory, N. Y.
Geometric Tool Co., New Haven
McCrosky Tool Corp., Meadville, Pa
National Tool Co., Cleveland
Ney Co., J. M., Hartford
Thomas Elevator Co., Chicago
Warner & Swasey Co., Cleveland
Whitney Mfg. Co., Hartford

Chucks, Centering
Cushman Chuck Co., Hartford
Thomas Elevator Co., Chicago

Chucks, Collet
Ney Co., J. M., Hartford
Rockford (Ill.) Milling Mach. Co.

Chucks, Drill and Tap
Cleveland (O.) Twist Drill Co.
Cons. Mach. Tool Corp., Rochester
Cushman Chuck Co., Hartford
Errington Mech. Laboratory, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Skinner Chuck Co., New Britain
Thomas Elevator Co., Chicago
Union Mfg. Co., New Britain
Wahlstrom Tool Co., Brooklyn
Whitney Mfg. Co., Hartford
Whiton Mch. Co., D. E., New London

Chucks, Lathe
Bullard Mach. Tool Co., Bridgeport
Casler, Herman, Canasota, N. Y.
Cushman Chuck Co., Hartford
Gisholt Mach. Co., Madison, Wis.

Self-opening Die

First Choice Goes to Murchey!

When a respectable proportion of machine tool builders furnish **MURCHEY** Self-Opening Dies and Collapsible Taps as standard equipment, you can rest assured they do so for but *one reason only.*

They have found out through experience that it is poor policy to risk their good name with anything less than the best.

MURCHEYS are so positive in performance that we offer to send any size on a 30-day trial offer.

May we send you illustrated catalog?

C. K. Chapin
President

Collapsible Taps

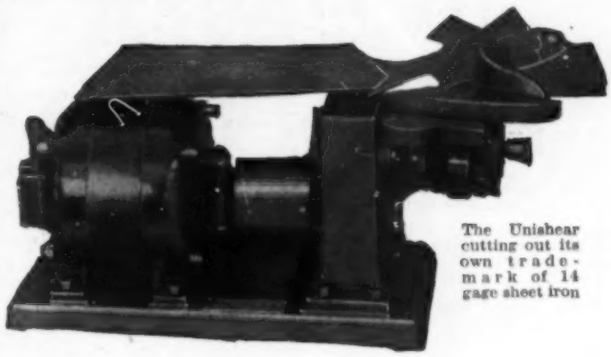
Murchey Machine & Tool Co.
953 Porter Street, Detroit, Mich., U. S. A.

AGENTS

Boston, Mass., 256 Franklin St., Standard Supply Co., Inc.; Cleveland Office, 6007 Euclid Ave.; Pittsburgh Representatives, Barney Machine Co., Union Trust Bldg.; Chicago Representatives, R. E. Ellis Engineering Co., 621 Washington Blvd.; Philadelphia, Pa., Haviland Wright, 2204 Packard Bldg.; Baltimore, Md., Kemp Machinery Co., 215 North Calvert St.; Los Angeles, Calif., De Long Almquist, 414 East Third St.; England, Coats Machine Tool Company, 14 Palmer Street, Westminster, London, S. W.; Paris, Fenwick Freres & Company, 8 Rue de Berry.

MURCHEY
Collapsible Taps and Self Opening Dies

UNISHEAR



The Unishear cutting out its own trade-mark of 14 gage sheet iron

Combines SPEED, ACCURACY and SAFETY on all Shop or Maintenance Cutting Jobs—

Production goes up and shop costs go down wherever the UNISHEAR is used to cut any straight, curved or irregular shape from sheet metal.

One man can easily operate it, by simply guiding the material between the cutters. No hard manual labor is necessary. He can run a continuous cut thru No. 14 gage cold rolled steel at the rate of 15 feet per minute and always see just what he is doing.

Where large sheets must be handled it is economical to mount the UNISHEAR sufficiently low, to bring the throat on a level with the top of the bench.

A ¼ hp. drives the rapidly oscillating lower cutter thru reduction gears, flexible coupling and eccentric. Power can be obtained from the nearest lamp socket.

Used by many leading shops. We will gladly send you Bulletin with list of users.

SPECIFICATIONS:

CAPACITY: Steel Sheets up to No. 14 U. S. Gage. Copper, etc., up to No. 12 U. S. Gage.

SPEED: 15 ft. per minute.

MOTOR: G. E. ¼ H.P., either A.C. or D.C. Specify Voltage and Cycles with order.

WEIGHT: 50 lbs. net. 70 lbs. gross.

DIMENSIONS: Packed 20 x 10 x 10-in.

We will gladly demonstrate the UNISHEAR on your work.

THE UNISHEAR COMPANY, Inc.
170 Fifth Avenue, New York, N. Y.

For export apply to:
Unishear Export Corporation, 104 Fifth Avenue, New York, N.Y.

Hoggson & Pettis Mfg. Co., New Haven
Ney Co., J. M., Hartford
Skinner Chuck Co., New Britain
Thomas Elevator Co., Chicago
Union Mfg. Co., New Britain
Whiton Mch. Co., D. E., New London

Chucks, Magnetic
Heald Mach. Co., Worcester
Taft-Peirce Mfg. Co., Woonsocket
Walker Co., O. S., Worcester

Chucks, Planer
Cincinnati (O.) Planer Co.
Hoggson & Pettis Mfg. Co., New Haven
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain

Chucks, Split
Ames Co., B. C., Waltham
Seneca Falls (N. Y.) Machine Co.
Stark Tool Co., Waltham

Chucks, Vertical Boring Mill
Bullard Mach. Tool Co., Bridgeport
Whiton Machine Co., D. E., New London

Chucks, Wrenchless
Thomas Elevator Co., Chicago

Clamps, Machinists'
Armstrong Bros. Tool Co., Chicago.
Reed Mfg. Co., Erie.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., N. Y.

Cleaning Equipment, Metal
American Foundry Equip. Co., Mishawaka, Ind.
Colts Patent Fire Arms Mfg. Co., Hartford

Clutch Shafts
American Hollow Boring Co., Erie, Pa.

Clutches, Friction
Brown Co., A. & F., N. Y.
Brown Eng. Co., Reading
Johnson Mach. Co., Carlyle, Manchester, Conn.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Moore & White Co., Philadelphia
Oesterlein Mach. Co., Cincinnati
Raybestos Co., Bridgeport

Coal and Ash Handling Machinery
Link-Belt Co., Chicago
Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.

Coal Storage Systems
Link-Belt Co., Chicago

Collars, Shaft or Set
Standard Pressed Steel Co., Phila.

Collars, Spacing
Detroit (Mich.) Stamping Co.

Collets
Brown & Sharpe Mfg. Co., Providence
Geometric Tool Co., New Haven
Hardinge Brothers, Inc., Chicago
Ney Co., J. M., Hartford
Union Twist Drill Co., Athol, Mass.
Wade Tool Co., Waltham
Whitney Mfg. Co., Hartford

Compounds, Carbonizing (See Case Hardening, etc.)

Compounds, Cleaning
Oakley Chemical Co., N. Y.

Compounds, Cutting, Drawing, Drilling, Grinding
Oakley Chemical Co., N. Y.
Sun Oil Co., Phila.

Compressors, Air and Gas
General Electric Co., Schenectady
Sullivan Machinery Co., Chicago

Condensers
Ingersoll-Rand Co., N. Y.

Conduits, Interior
General Electric Co., Schenectady

Cones, Friction
Evans Fric. Cone Co., Newton Centre, Mass.

Contract Work
Ames Co., B. C., Waltham
Atlas Mfg. Co., New Haven, Conn.
Barber-Colman Co., Rockford
Boston (Mass.) Scale & Machine Co.
Brock, Jr., T. & M. Wks., Arthur, Phila.
Brown & Sharpe Mfg. Co., Providence
Chowning Regulator Corp., Corning, N. Y.
Columbus (O.) Die T. & Mch. Co.
Demco, Inc., Baltimore
Detroit (Mich.) Stamping Co.
Elgin (Ill.) Metal Novelty Co.
Franklin Mch. Co., Providence.
Gisholt Mach. Co., Madison, Wis.
Hart & Co., Inc., Frederick, Poughkeepsie, N. Y.
Hartford (Conn.) Special Mchy. Co.
Hoefer Mfg. Co., Freeport, Ill.
Keller Mech. Eng. Co., Brooklyn
Lakeside Steel Improvement Co., Cleveland
Lambert & Todd Mch. Co., Camden.
Liberty Tool & Gage Wks., Woonsocket, R. I.
Longelier Mfg. Co., Cranston, R. I.
Lincoln Mach. Co., Pawtucket
Mehl Mach. T. & D. Co., Roselle, N. J.
Meisel Press Mfg. Co., Boston
Miller, Inc., Wm. J., Swissvale, Pa.
Niles Tool Works Co., N. Y.
Oxweld Acetylene Co., Long Island City, N. Y.
Reynolds Machine Co., Massillon, O.
Rowbottom Machine Co., Waterbury
Shartle Bros., Mach. Co., Middletown, Ohio
Sloan & Chase, Inc., Newark, N. J.
Sprague Corp., N. Y.
Taft-Peirce Mfg. Co., Woonsocket
Toledo (O.) Mach. & Tool Co.
Underwood Corp., H. B., Philadelphia
Waltham (Mass.) Mch. Wks.
White Mfg. Co., S. S., N. Y
Willys Morrow Co., Inc., Elmyra, N. Y.

Controllers, Temperature
Taylor Instrument Co.'s, Rochester, N. Y.

Controllers and Starters, Electric
General Electric Co., Schenectady
Union Electric Mfg. Co., Milwaukee

Converters
General Electric Co., Schenectady

Conveyors
Standard Conveyor Co., No. St. Paul, Minn.

Counterbores
Cleveland (O.) Twist Drill Co.
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford, Conn.
Slocomb Co., J. T., Providence

Countershafts
Brown & Sharpe Mfg. Co., Providence
Diamond Mch. Co., Providence
Evans Fric. Cone Co., Newton Centre, Mass.
Standard Pressed Steel Co., Phila.

Countersinks
Clark Equipment Co., Buchanan, Mich.
Greenfield (Mass.) Tap & Die Corp.

Counting Machines
Bristol Co., Waterbury
Durant Mfg. Co., Milwaukee
Hart Mfg. Co., R. A., Battle Creek
Veeder Mfg Co., Hartford

Couplings, Flexible
Boston Gear Wks. Sales Co., Quincy, Mass.
Brown Engineering Co., Reading
Foote Bros. Gear & Mach. Co., Chicago
Jones Fdry. & Machine Co., W. A., Chicago
Philadelphia (Pa.) Gear Works

Couplings, Shaft
Foote Bros. Gear & Mach. Co., Chicago
Johnson Mach. Co., Carlyle, Manchester, Conn.
Nicholson & Co., W. H., Wilkes-Barre
Standard Pressed Steel Co., Phila.

Cranes, Locomotive
Link-Belt Co., Chicago

Cranes, Traveling
Niles Tool Works, N. Y.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Crank Pin Turning Machines
Underwood Corp., H. B., Phila.

Cut-Outs, Electric
General Electric Co., Schenectady

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton, Conn.
Union Twist Drill Co., Athol, Mass.

Cutters, Keyseater
Davis Keyseater Co., Rochester

Cutters, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Butterfield & Co., Derby Line, Vt.
Geometric Tool Co., New Haven
Ingersoll Mill Mch. Co., Rockford
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Co., Worcester
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford

Cutting, Apparatus, Oxyacetylene
Oxweld Acetylene C., Long Island City, N. Y.

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago.
Armstrong Bros. Tool Co., Chicago.
Brown & Sharpe Mfg. Co., Providence
Etna Machine Co., Toledo
Gorton Mach. Co., Geo., Racine
Greenfield (Mass.) Tap & Die Corp.
Landis Mach. Co., Waynesboro
Pratt & Whitney Co., Hartford, Conn.

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago

Dealers, Machinery (See Searchlight Section)
Adams Co., Ogden J., Rochester
Allen Co., Inc., H. F., N. Y.
Botwinik Bros., New Haven, Conn.
Brownell Mach. Co., Providence
Clarkson, D. R., Rochester, N. Y.
Delta Equip. Co., Phila.
Duff Machinery Corp., N. Y.
Eddy Machy. Co., E. A., Providence
Essley Mchy. Co., E. L., Chicago
Hill, Clarke & Co., Inc., Boston
Hill, Clarke & Co., Chicago
Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainville, Conn.
International Machy. Co., Detroit
Lamberg & Co., A., N. Y.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Marshall-Huschart Machy. Co., Chicago
Miles Mchy. Co., Saginaw
Morey & Co., N. Y.
Moyer, J. N., Phila.
Naham Tool & Supply Co., N. Y.
Niles & Co., F. H., Jersey City, N. J.
Niles-Bement-Pond Co., N. Y.
Niles Tool Works Co., N. Y.
Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y
Riverside Machy. Depot, Detroit
Ryerson & Son, Jos. T., Chicago
Simmons Mach. Tool Corp., Albany
Strong, Carlisle & Hammond Co., Cleveland
Wickes Mchy. Co., Jersey City, N. J.

Demagnetizers
Wickes Mchy. Co., Jersey City, N. J.

Diamond Tools
Desmond-Stephan Mfg. Co., Urbana
Dickinson, Thomas L., N. Y.
Wheel Trueing Tool Co., Detroit

Die Holders for Presses
Danly Mach. Spec., Inc., Chicago
U. S. Tool Co., Ampere, N. J.

Die Making Machines
Haskins Co., R. G., Chicago
Keller Mech. Eng. Co., Brooklyn

Die Sets
Danly Machine Specialties, Inc., Chicago

Dies, Forging
Butterfield & Co., Derby Line, Vt.
Keller Mech. Eng. Co., Brooklyn
Steel Products Eng. Co., Springfield, O.
White Dental Mfg. Co., S. S., N. Y.

Dies, Self-opening Adjustable
Cons. Mach. Tool Corp., Rochester
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit

Dies, Sheet Metal and Sub-Press (See Contract Work)

Dies, Threading-Opening
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Greenfield (Mass.) Tap & Die Corp.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Machinery Co., Tiffin.

Dies, Trimming
Steel Products Engr. Co., Springfield, O.

Dividing Heads
Knight Mchy. Co., W. B., St. Louis
U. S. Mch. Tool Co., Cincinnati

Dogs, Lathes & Milling Machines
Armstrong Bros. Tool Co., Chicago

Dressers, Grinding Wheel
Bay State Stamping Co., Worcester
Desmond-Stephan Mfg. Co., Urbana
Norton Co., Worcester

Drill Bushings
Acme Industrial Co., Chicago

Drill Holders
Armstrong Bros. Tool Co., Chicago

Drill Speeders
Graham Mfg. Co., Providence

Drilling Machine Heads
Buhr Machine Tool Co., Ann Arbor, Mich.
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Cranston, R. I.
Rockford (Ill.) Drilling Machine Co.
U. S. Drill Head Co., Cincinnati

Drilling Machines, Automatic
Baker Bros., Toledo
Barnes Drill Co., Rockford, Ill.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Fox Mach. Co., Jackson, Mich.
Hoefer Mfg. Co., Freeport, Ill.
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
Nat'l Automatic Tool Co., Richmond
Rockford (Ill.) Drilling Machine Co.

Drilling Machines, Bench
Ames Co., B. C., Waltham
Clark Electric Co., Jas., Jr., Louisville
Langelier Mfg. Co., Cranston, R. I.
Rockford (Ill.) Drilling Mach. Co.
Silver Mfg. Co., Salem
Sloan & Chase, Inc., Newark, N. J.
Taylor & Fenn Co., Hartford.

Drilling Machines, Gang
Baker Bros., Toledo
Barnes Drill Co., Rockford
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Cranston, R. I.
Moline (Ill.) Tool Co.
Rockford (Ill.) Drilling Machine Co.
Silver Mfg. Co., Salem, Ohio
Taylor & Fenn Co., Hartford

Drilling Machines, Heavy Duty
Baker Bros., Toledo
Barnes Drill Co., Inc., Rockford
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Hoefer Mfg. Co., Freeport, Ill.
Rockford (Ill.) Drilling Machine Co.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle
Baker Bros., Toledo
Barnes Drill Co., Rockford, Ill.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Fox Mach. Co., Jackson, Mich.
Grant Mfg. & Mch. Co., Bridgeport
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
National Acme Co., Cleveland
Nat'l Automatic Tool Co., Richmond
Niles Tool Works Co., N. Y.
Pratt & Whitney Co., Hartford, Conn.
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia

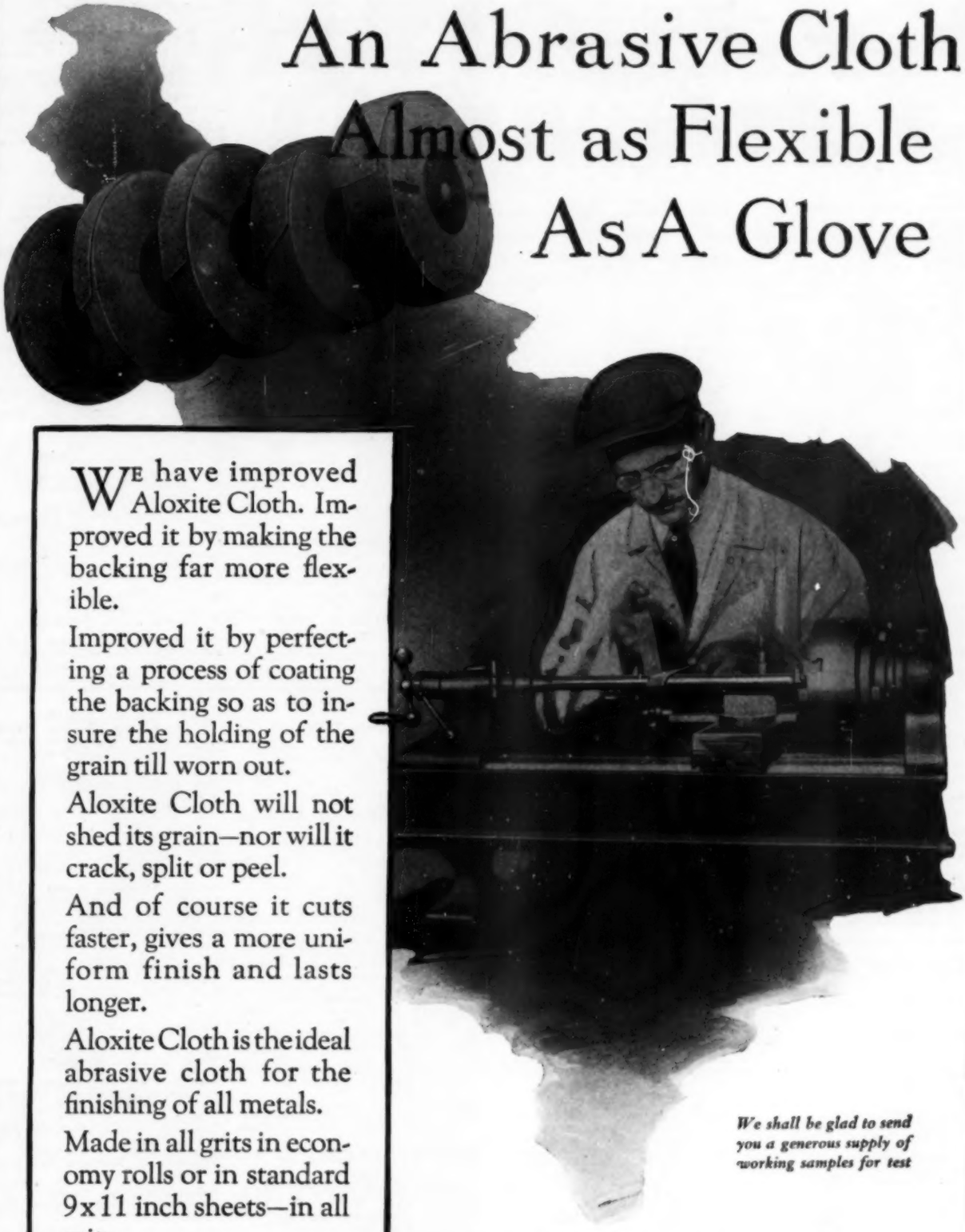
Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Carlton Mach. Tool Co., Cincinnati
Cincinnati (O.) Bickford Tool Co.
Dreses Mch. T. Co., Cincinnati
Mueller Mch. Tool Co., Cincinnati
Niles Tool Works Co., N. Y.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia

Drilling Machines, Sensitive
Ames Co., B. C., Waltham
Carlton Mach. Tool Co., Cincinnati
Hardinge Brothers, Inc., Chicago
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
Leland Gifford Co., Worcester
Merit Oil Equipment Co., Cleveland
Taylor & Fenn Co., Hartford
U. S. Mch. Tool Co., Cincinnati
Wisconsin Electric Co., Racine

Drilling Machines, Turret
Hoefer Mfg. Co., Freeport, Ill.
Kingsbury Mfg. Co., Keene, N. H.
Nat'l Automatic Tool Co., Richmond, Ind.

Drilling Machines, Vertical
Baker Bros., Toledo
Barnes Drill Co., Inc., Rockford
Buffalo (N. Y.) Forge Co.
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Kingsbury Mfg. Co., Keene, N. H.
Knight Mchy. Co., W. B., St. Louis
Langelier Mfg. Co., Cranston, R. I.
Leland-Gifford Co., Worcester
Merit Oil Equipment Co., Cleveland
Rockford (Ill.) Drilling Machine Co.
Ryerson & Son, Jos. T., Chicago
Silver Mfg. Co., Salem, Ohio
Taylor & Fenn Co., Hartford
U. S. Mch. Tool Co., Cincinnati

An Abrasive Cloth Almost as Flexible As A Glove



WE have improved Aloxite Cloth. Improved it by making the backing far more flexible.

Improved it by perfecting a process of coating the backing so as to insure the holding of the grain till worn out.

Aloxite Cloth will not shed its grain—nor will it crack, split or peel.

And of course it cuts faster, gives a more uniform finish and lasts longer.

Aloxite Cloth is the ideal abrasive cloth for the finishing of all metals.

Made in all grits in economy rolls or in standard 9x11 inch sheets—in all grits.

We shall be glad to send you a generous supply of working samples for test

THE CARBORUNDUM COMPANY
NIAGARA FALLS, N. Y.

New York : Chicago : Boston : Philadelphia : Cleveland : Detroit
Cincinnati : Pittsburgh : Milwaukee : Grand Rapids

Drills, Center
Clark Equipment Co., Buchanan, Mich.
Cleveland (O.) Twist Drill Co.
Merit Oil Equipment Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Slocomb Co., J. T., Providence
Union Twist Drill Co., Athol, Mass.

Drills, Portable, Electric and Pneumatic
Buckeye Portable Tool Co., Dayton
Clark Electric Co., Jas., Jr., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Wisconsin Electric Co., Racine

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago
Clark Equipment Co., Buchanan, Mich.
Cleveland (O.) Twist Drill Co.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

Drills, Twist and Flat
Buckeye Twist Drill Co., Alliance
Butterfield & Co., Derby Line, Vt.
Clark Equipment Co., Buchanan, Mich.
Cleveland (O.) Twist Drill Co.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Electrical Instruments
General Electric Co., Schenectady

Electrical Supplies
General Electric Co., Schenectady
Hart & Hegeman Mfg. Co., Hartford
Simplex Wire & Cable Co., Boston

Elevating Trucks (See Trucks)

Elevators and Conveyors
Caldwell & Son Co., H. W., Chicago
Link-Belt Co., Chicago

Emery Wheels (See Grinding Wheels)

Engineers, Industrial and Mechanical
Hartford (Conn.) Special Mchy. Co.
Underwood Corp., H. B., Philadelphia

Engraving Machinery
Gorton Mach. Co., Geo., Racine
Keller Mech. Eng. Co., Brooklyn
Preis & Co., H., Newark, N. J.

Expanders, Tube
Watson-Stillman Co., N. Y.

Eyeglass, Safety (See Goggles, Safety)

Fans, Electric
General Electric Co., Schenectady

Fans, Ventilating
General Electric Co., Schenectady

Files and Rasps
American Swiss File & Tool Co., Elizabeth, N. J.

Filing Machines
Ames Co., B. C., Waltham
Cochrane-Bly Co., Rochester, N. Y.
Haskins Co., R. G., Chicago
Oliver Instrument Co., Adrian, Mich.

Filler, Iron (See Cement, Iron)

Fittings, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Flanging Machines, Tube
Grant Mfg. & Mch. Co., Bridgeport

Forging Machinery
Acme Mchy. Co., Cleveland
National Mchy. Co., Tiffin

Forgings, Drop
Bradley & Son, C. C., Syracuse, N. Y.

Forgings, Hollow Bored
American Hollow Boring Co., Erie, Pa.

Fountains, Drinking
Manufacturing Equipment & Engr. Co., Framingham, Mass.

Furnaces, Forging
American Gas Furnace Co., Elizabeth

Furnaces, Heat-Treating
American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
Johnson Gas Appliance Co., Cedar Rapids
Strong, Carlisle & Hammond Co., Cleveland

Furnaces, Tempering and Annealing
American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
General Electric Co., Schenectady
Johnson Gas Appliance Co., Cedar Rapids
Strong, Carlisle & Hammond Co., Cleveland

Furniture, Machine Shop
Armstrong Bros. Tool Co., Chicago
Brown Eng. Co., Reading
Manufacturing Equipment & Engr. Co., Framingham, Mass.

Gage Blocks
Pratt & Whitney Co., Hartford, Conn.

Gages, Comparator
Federal Products Corp., Providence
Jones & Lamson Mach. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Randall & Stickney, Waltham, Mass.
Starrett Co., L. S., Athol, Mass.

Gages, Plug and Ring
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford, Conn.

Gages, Recording
Bristol Co., Waterbury
Taylor Instrument Co.'s, Rochester, N. Y.

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Greenfield (Mass.) Tap & Die Corp.
Pratt & Whitney Co., Hartford, Conn.
Taft-Peirce Mfg. Co., Woonsocket

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Greenfield (Mass.) Tap & Die Corp.
Hartford (Conn.) Special Mchy. Co.
Pratt & Whitney Co., Hartford, Conn.

Gaskets
Graton & Knight Mfg. Co., Worcester, Mass.

Gear Cutting Machines
Adams Co., Dubuque
Barber-Colman Co., Rockford
Bilgram Mch. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Cut. Mch. Co.
Fellows Gear Shaper Co., Springfield, Vt.
Flather Co., Nashua
Gleason Works, Rochester
Lees-Bradner Co., Cleveland
Newark (N. J.) Gear Cutting Mch. Co.
Schuchardt & Schutte (Scherr, George), N. Y.
Sloan & Chase, Inc., Newark, N. J.
Wade Tool Co., Waltham
Waltham (Mass.) Mch. Works
Whiton Mch. Co., D. E., New London

Gear Tempering Machinery
Gleason Works, Rochester

Gear Testing Machinery
Adams Co., Dubuque, Iowa
Brown & Sharpe Mfg. Co., Providence
Gleason Works, Rochester
Lees-Bradner Co., Cleveland
Newark (N. J.) Gear Cutting Mch. Co.

Gears, Cast
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son, H. W., Chicago
Cleveland (O.) Worm & Gear Co.
Franklin Die Cast Corp., Syracuse
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Pennsylvania Gear & Machine Co., Phila.
Philadelphia (Pa.) Gear Wks.,

Gears, Cut
Adams Co., Dubuque, Iowa
Albaugh-Dover Mfg. Co., Chicago
Bilgram Mch. Wks., Philadelphia
Boston Gear Wks. Sales Co., Norfolk Downs
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Co.
Cleveland (O.) Worm & Gear Co.
Diefendorf Gear Corp., Syracuse
Earle Gear & Machine Co., Phila.
Fawcus Mch. Co., Pittsburgh
Fellows Gear Shaper Co., Springfield, Vt.
Flather Co., Nashua
Foote Bros. Gear & Mach. Co., Chicago
Franklin Die Casting Corp, Syracuse
Ganschow Co., Wm., Chicago
General Electric Co., Schenectady
Gleason Works, Rochester
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Meisel Press Mfg. Co., Boston
Newark (N. J.) Gear Cutting Mch. Co.
Niles Tool Works Co., N. Y.
Nuttall Co., R. D., Pittsburgh
Pennsylvania Gear & Machine Co., Phila.
Philadelphia (Pa.) Gear Wks.
Simonds Mfg. Co., Pittsburgh

Gears, Forged
Grant Gear Wks., Inc., Boston
Philadelphia (Pa.) Gear Works

Gears, Speed Reducers
Albaugh-Dover Mfg. Co., Chicago
Boston Gear Wks. Sales Co., Quincy, Mass.
Cleveland (O.) Worm & Gear Co.
Earle Gear & Mach. Co., Phila.
Foote Bros. Gear & Mach. Co., Chicago
Grant Gear Wks., Inc., Boston
Horsburgh & Scott Co., Cleveland
Niles Tool Works Co., N. Y.
Philadelphia (Pa.) Gear Works

Generators, Acetylene
Oxweld Acetylene Co., Long Island City, N. Y.

Generators, Electric
General Electric Co., Schenectady
Reliance Elect. & Eng. Co., Cleveland

Grease Cups
Greas-om eter Corp., San Francisco

Greases, Lubricating
Sun Oil Co., Phila.

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Automatic Head and End
Arter Grinding Mach. Co., Worcester, Mass.

Grinding Machines, Bench
Brown & Sharpe Mfg. Co., Providence
Clark Electric Co., Jas., Jr., Louisville
Diamond Mch. Co., Providence
Greenfield (Mass.) Tap & Die Corp.
Haskins Co., R. G., Chicago
Norton Co., Worcester
Ryerson & Son, Jos. T., Chicago
Safety Emery Wheel Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester

Grinding Machines, Centerless
Cincinnati (O.) Milling Mach. Co.

Grinding Machines, Chaser
Geometric Tool Co., New Haven
National Acme Co., Cleveland

Grinding Machines, Chucking
Blanchard Mch. Co., Cambridge
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Diamond Mch. Co., Providence
Fafnir Bearing Co., New Britain
Gallmeyer & Livingston Co., Grand Rapids
Greenfield (Mass.) Tap & Die Corp.
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
LeBlond Mach. Tool Co., Cincinnati
Oesterlein Mach. Co., Cincinnati
Norton Co., Worcester
Reed Prentice Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadlphia
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol, Mass.
Universal Grinding Mach. Co., Fitchburg, Mass.
Walker Co., O. S., Worcester
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Cylindrical
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati (O.) Grinder Co.
Cons. Mach. Tool Corp., Rochester
Fitchburg (Mass.) Grinding Mach. Co.
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Norton Co., Worcester
Oesterlein Mach. Co., Cincinnati
Universal Grinding Mach. Co., Fitchburg, Mass.
Van Norman Mach. Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester

Grinding Machines, Die
Abrasive Mch. T. Co., E. Providence
Arter Grinding Mach. Co., Worcester, Mass.
Bignall & Keeler Machine Wks., Edwardsville
Blanchard Mach. Co., Cambridge
Diamond Mch. Co., Providence
Geometric Tool Co., New Haven
Heald Mch. Co., Worcester
Landis Mach. Co., Waynesboro
Murchey Mach. & T. Co., Detroit
National Acme Co., Cleveland
National Mchy. Co., Tiffin
Walker Co., O. S., Worcester
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Disc
Badger Tool Co., Beloit, Wis.
Besly & Co., Chas. H., Chicago
Diamond Mch. Co., Providence
Rowbottom Machine Co., Waterbury

Grinding Machines, Drill and Tap
Gallmeyer & Livingston Co., Grand Rapids
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Face or Ring Wheel
Abrasive Mch. T. Co., E. Providence
Besly & Co., Chas. H., Chicago
Blanchard Mach. Co., Cambridge
Diamond Mch. Co., Providence
Graham Mfg. Co., Providence
Safety Emery Wheel Co., Springfield, O.
Walker Co., O. S., Worcester

Grinding Machines, Floor
Brown & Sharpe Mfg. Co., Providence
Diamond Mch. Co., Providence
Norton Co., Worcester
Ryerson & Son, Jos. T., Chicago
Safety Emery Wheel Co., Springfield, O.

Grinding Machines, Gage
Abrasive Mch. T. Co., E. Providence
Landis Tool Co., Waynesboro
Wilmarth & Morman Co., Grand Rapids

Grinding Machine, Gear
Lees-Bradner Co., Cleveland

Grinding Machines, Internal
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati (O.) Grinder Co.
Greenfield (Mass.) Tap & Die Corp.
Heald Machine Co., Worcester
Hjorth Lathe & Tool Co., Boston
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Corp., Boston
Universal Grinding Mach. Co., Fitchburg, Mass.
Van Norman Mach. Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester

Grinding Machines, Piston Ring
Arter Grinding Mach. Co., Worcester, Mass.
Heald Machine Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.

Grinding Machines, Portable
Armstrong-Blum Mfg. Co., Chicago
Buckeye Portable Tool Co., Dayton
Clark Electric Co., Jas., Jr., Louisville
Haskins Co., R. G., Chicago
Neil & Smith Elec. T. Co., Cincinnati
Porter Cable Mach. Co., Syracuse, N. Y.
Wisconsin Electric Co., Racine

Grinding Machines, Pulley
Graham Mfg. Co., Providence

Grinding Machines, Radial
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Snagging
Diamond Mch. Co., Providence

Grinding Machines, Surface
Abrasive Mch. T. Co., E. Providence
Arter Grinding Mach. Co., Worcester, Mass.
Badger Tool Co., Beloit, Wis.
Blanchard Mch. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Diamond Mch. Co., Providence
Heald Mach. Co., Worcester
Norton Co., Worcester
Pratt & Whitney Co., Hartford, Conn.
Rowbottom Machine Co., Waterbury
Safety Emery Wheel Co., Springfield, O.
Universal Grinding Mach. Co., Fitchburg, Mass.
Walker Co., O. S., Worcester
Wilmarth & Morman Co., Grand Rapids

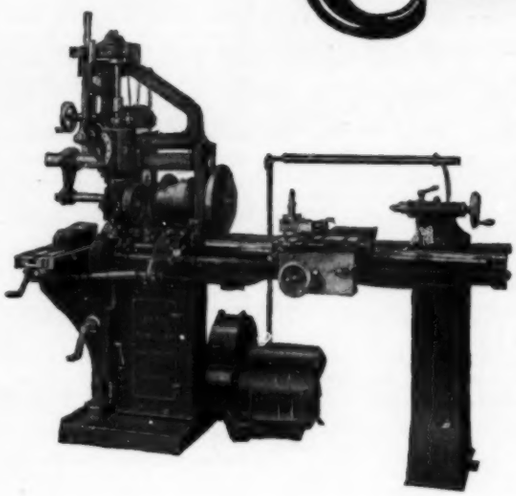
Grinding Machines, Tappet
Fitchburg (Mass.) Grinding Mach. Co.

Grinding Machines Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Grinder Co.
Gallmeyer & Livingston Co., Grand Rapids
Gisholt Mach. Co., Madison, Wis.
Greenfield (Mass.) Tap & Die Corp.
Landis Tool Co., Waynesboro
Norton Co., Worcester
Universal Grinding Mach. Co., Fitchburg, Mass.
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Valve Seat
Carborundum Co., Niagara Falls, N. Y.
Fitchburg (Mass.) Grinding Mach. Co.

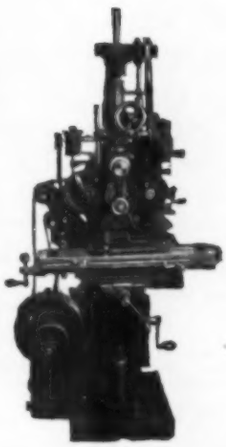
"DALTON COMBINATION"

With Motor Drive



The Dalton Combination is a lathe, a milling machine and a drilling machine combined into one universal machine tool. It is ideal for the repair shop, the garage, the steamship and the small manufacturing plant.

Turning, boring and all lathe operations; horizontal and vertical milling; drilling, reaming and tapping are performed with the same speed and accuracy that is possible on separate machines.



Write for Complete Details

DALTON TOOL CORP.
Willow Avenue and 133rd Street, NEW YORK CITY, U. S. A.
Cable Address: "HUKDAL NEW YORK"
Agents for California, Arizona and Nevada—Smith, Booth, Usher Co., 50 Fremont St., San Francisco—226 Central Ave., Los Angeles

A No. 77 A.C. Ball Bearing Floor Grinder

will serve you efficiently

The wheels are run at the proper speed to get economical grit cost—odd size wheels are not recommended.

There is practically no maintenance cost. Foot lever control is recommended for occasional grinding, Push Button control for regular production work.

We also build Grinders for all sizes of wheels up to 30 inch diameter.

Grinding Wheels for Every Purpose

Write us

THE SAFETY EMERY WHEEL CO.
Springfield, Ohio

Grinding Wheels
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.

Guards, Safety
Dickgeisser & Co., Charles S., Derby, Conn.

Hammers, Drop
Bradley & Son, C. C., Syracuse, N.Y.
Niles Tool Works Co., N. Y.

Hammers, Power
Bliss Co., E. W., Brooklyn
Bradley & Son, C. C., Syracuse, N.Y.
Ryerson & Son, Joseph T., Chicago

Hammers, Steam
Niles Tool Works Co., N. Y.

Handles, Machine
Rockwood Sprinkler Co., Worcester

Hangers, Shaft
American Pulley Co., Phila.
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Fafnir Bearing Co., New Britain
Jones Fdry. & Machine Co., W. A., Chicago
Standard Pressed Steel Co., Phila.

Hardness Measuring Instruments, Steel
Shore Instrument & Mfg. Co., Jamaica, N. Y.

Heaters, Rivet
American Gas Furnace Co., Elizabeth, N. J.

Heat Treating, Commercial
Lakeside Steel Improvement Co., Cleveland

Hobbing Machines
Adams Co., Dubuque
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Cutting Mch. Co.
Newark (N. J.) Gear Cutting Mch. Co.
Schuchardt & Schutte (Scherr, George), N. Y.

Hobs
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Greenfield (Mass.) Tap & Die Corp.
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Newark (N. J.) Gear Cutting Mch. Co.
Philadelphia (Pa.) Gear Works
Union Twist Drill Co., Athol, Mass.

Hoists, Electric
American Eng. Co., Philadelphia
Elwell Parker Electric Co., Cleveland
General Electric Co., Schenectady
Link-Belt Co., Chicago
Niles Tool Works Co., N. Y.
Reading (Pa.) Chain & Block Corp.
Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.

Hoists, Hand
Ford Chain Block Co., Phila.
Reading (Pa.) Chain & Block Corp.

Hoists, Pneumatic
Sullivan Mchy. Co., Chicago

Honing Machines
Barnes Drill Co., Rockford, Ill.

Hydraulic Machinery
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.
Veeder Mfg. Co., Hartford
Waterston, J. M., Detroit

Instruments, Temperature
Taylor Instrument Co.'s, Rochetser, N. Y.

Jacks, Hydraulic
Watson-Stillman Co., N. Y.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago

Jig Bushings
Acme Industrial Co., Chicago
Ex-Cell-O Tool & Mfg. Co., Detroit

Jigs and Fixtures
(See Contract Work)

Joints, Universal
Boston Gear Works, Sales Co., Norfolk Downs
Fox Mach. Co., Jackson, Mich.
Gray & Prior Mach. Co., Hartford
Nat'l Automatic Tool Co., Richmond

Kettles, Soda
Brown & Sharpe Mfg. Co., Providence
Gray & Prior Mch. Co., Hartford

Keyseating Machines
Baker Bros., Toledo
Davis Keyseater Co., Rochester
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson, Mass.
Mitts & Merrill, Saginaw.
Morton Mfg. Co., Muskegon Heights, Mich.

Keys, Machine
Morton Mfg. Co., Muskegon Heights, Mich.
Whitney Mfg. Co., Hartford

Lamps, Electric
General Electric Co., Schenectady

Lapping Machines, Cylindrical and Flat
Bethel-Player Co., Westboro, Mass.

Lathe Attachments
Ames, B. C., Waltham
Dalton Tool Corp., N. Y.
Flather Co., Nashua

Lathe Spindles
American Hollow Boring Co., Erie, Pa.

Lathe Tools
Armstrong Bros. Tool Co., Chicago.
O. K. Tool Co., Shelton, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Mach. Co., Madison, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., Windsor, Vt.
Potter & Johnston Mch. Co., Pawtucket.
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Co., Worcester.
Rockford (Ill.) Tool Co.
Seneca Falls (N. Y.) Machine Co.
South Bend (Ind.) Lathe Works
Steinle Turret Mch. Co., Madison, Wis.

Lathes, Bench
Ames Co., B. C., Waltham
Brown & Sharpe Mfg. Co., Providence
Dalton Tool Corp., N. Y.
Diamond Mch. Co., Providence
Hardinge Brothers, Inc., Chicago
Hjorth Lathe & Tool Co., Boston.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Corp., Boston
Seneca Falls (N. Y.) Machine Co.
Sloan & Chase, Inc., Newark, N. J.
South Bend (Ind.) Lathe Works
Stark Tool Co., Waltham.
Van Norman Mach. Tool Co., Springfield, Mass.
Wade Tool Co., Waltham

Lathes, Boring
Potter & Johnston Mch. Co., Pawtucket
Rockford (Ill.) Tool Co.

Lathes, Chucking (See Lathes, Horizontal and Vertical Turret)

Lathes, Engine
Acme Mach. Tool Co., Cincinnati
American Tool Wks. Co., Cincinnati
Bradford Mch. Tool Co., Cincinnati
Carroll & Jamieson Mach. Tool Co., Batavia, O.
Cons. Mach. Tool Corp., Rochester
Dalton Tool Corp., N. Y.
Flather Co., Nashua
Greaves-Klusman T. Co., Cincinnati
Hendey Mach. Co., Torrington, Conn.
LeBlond Mach. Tool Co., Cincinnati
Lodge & Shipley Mch. T. Co., Cincinnati.
Monarch Machine Tool Co., Sidney
Mueller Mch. Tool Co., Cincinnati
Niles Tool Works Co., N. Y.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Co., Worcester
Rockford (Ill.) Tool Co.
Ryerson & Son, Jos. T., Chicago
Seneca Falls (N. Y.) Machine Co.
South Bend (Ind.) Lathe Works
Springfield (O.) Mach. Tool Co.
Wickes Bros., Saginaw

Lathes, Extension and Gap
American Tool Wks. Co., Cincinnati

Lathes, Foot Power
Dalton Tool Corp., N. Y.
Seneca Falls (N. Y.) Machine Co.

Lathes, Fox
Bardons & Oliver, Cleveland

Lathes, Gap
South Bend (Ind.) Lathe Works

Lathes, Horizontal and Vertical Turret
Acme Mach. Tool Co., Cincinnati
Bardons & Oliver, Cleveland
Bullard Mach. Tool Co., Bridgeport
Dreses Mch. Tool Co., Cincinnati
Gisholt Mach. Co., Madison, Wis.
Internat. Mch. T. Co., Indianapolis
Jones & Lamson Mch. Co., Springfield, Vt.
Niles Tool Works Co., N. Y.
Pratt & Whitney Co., Hartford, Conn.
Steinle Turret Mch. Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)

Lathes, Spinning
Adriance Mach. Wks., Inc., Brooklyn

Lathes, Toolroom
Hardinge Brothers, Inc., Chicago
Pratt & Whitney Co., Hartford, Conn.
Rockford (Ill.) Tool Co.

Lathes, Woodturning
Seneca Falls (N. Y.) Machine Co.

Leather, Hydraulic
Graton & Knight Mfg. Co., Worcester, Mass.

Letters and Figures
Brown & Sharpe Mfg. Co., Providence
Hoggson & Pettis Mfg. Co., New Haven.

Level Precision Machines, Aligning
Pratt & Whitney Co., Hartford, Conn.
Universal Boring Mach. Co., Hudson, Mass.

Lighting Fixtures
General Electric Co., Schenectady

Lining, Brake & Clutch
Raybestos Co., Bridgeport

Lubricants
Oakley Chemical Co., N. Y.
Sun Oil Co., Phila.

Lubricating Systems
Greas-om-eter Corp., San Francisco

Machinists' Small Tools
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham, Mass.
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket

Mandrels, Expanding
Brown & Sharpe Mfg. Co., Providence
Nicholson & Co., W. H., Wilkes-Barre

Mandrels, Solid
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Twist Drill Co.
Nicholson & Co., W. H., Wilkes-Barre
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass

Marking Devices (See Stamps, Steel)

Marking Machines
Hjorth Lathe & Tool Co., Boston
Noble & Westbrook Mfg. Co., Hartford

Marking Tools
Schmidt, Inc., Geo. T., Chicago

Measuring Machines
Bethel-Player Co., Westboro, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney Co., Hartford, Conn.
Schuchardt & Schutte (Scherr, George), N. Y.

Metal Drawing
Lashbough-Jordan Tool & Mach. Co., Elkhart, Ind.

Meters, Steam Flow
General Electric Co., Schenectady

Micrometers, Bench
Pratt & Whitney Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham, Mass.
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.

Milling Attachments
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Hendey Mach. Co., Torrington, Conn.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker, Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mach. Tool Co., Cincinnati
Oesterlein Mach. Co., Cincinnati
Porter Cable Mach. Co., Syracuse, N. Y.
Potter & Johnston Mch. Co., Pawtucket.
Reed-Prentice Co., Worcester
Rockford (Ill.) Milling Mach. Co.
South Bend (Ind.) Lathe Works
Whitney Mfg. Co., Hartford

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Ingersoll Mill Mch. Co., Rockford
Pratt & Whitney Co., Hartford, Conn.
Rockford (Ill.) Milling Mach. Co.

Milling Machines, Bench
Ames Co., B. C., Waltham
Hardinge Brothers, Inc., Chicago
Pratt & Whitney Co., Hartford, Conn.
Rockford (Ill.) Milling Mach. Co.
Sloan & Chase, Inc., Newark, N. J.
Stark Tool Co., Waltham
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Continuous
Cons. Mach. Tool Corp., Rochester
Ingersoll Mill. Mch. Co., Rockford
Potter & Johnston, Mch. Co., Pawtucket.
Rockford (Ill.) Milling Mach. Co.

Milling Machines, Duplex
Cincinnati (O) Milling Mach. Co.
Ingersoll Mill Mch Co., Rockford
Knight Mchy. Co., W. B., St. Louis
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Hand
Adams Co., Dubuque, Iowa
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Kempsmith Mfg. Co., Milwaukee
Pratt & Whitney Co., Hartford, Conn.
Rockford (Ill.) Milling Mach. Co.
U. S. Mch. Tool Co., Cincinnati
Van Norman Mach. Tool Co., Springfield, Mass.
Whitney Mfg. Co., Hartford

Milling Machines, Horizontal and Planer Type
Cons. Mach. Tool Corp., Rochester
Ingersoll Mill Mch. Co., Rockford
Niles Tool Works Co., N. Y.

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Hendey Mach. Co., Torrington, Conn.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker, Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mach. Tool Co., Cincinnati
Potter & Johnston Mch. Co., Pawtucket
Rockford (Ill.) Milling Mach. Co.
Ryerson & Son, Joseph T., Chicago
U. S. Mch. Tool Co., Cincinnati
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines for Planers
Adams Co., Dubuque, Iowa.
Niles Tool Works Co., N. Y.

Milling Machines, Portable
Ingersoll Mill Mach. Co., Rockford
Underwood Corp., H. B., Phila.

Milling Machines, Thread
Hall Planetary Co., Philadelphia
Lees-Bradner Co., Cleveland
Pratt & Whitney Co., Hartford, Conn.
Taft-Peirce Mfg. Co., Woonsocket
Waltham (Mass.) Mch. Works

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Hendey Mach. Co., Torrington, Conn.
Ingersoll Mill Mch. Co., Rockford
Kearney & Trecker, Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mach. Tool Co., Cincinnati
Oesterlein Mach. Co., Cincinnati
Potter & Johnston Mch. Co., Pawtucket
Rockford (Ill.) Milling Mach. Co.
Ryerson & Son, Joseph T., Chicago
U. S. Mch. Tool Co., Cincinnati
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Vertical
Ames Co., B. C., Waltham
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Cons. Mach. Tool Corp., Rochester
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker, Milwaukee
Kempsmith Mfg. Co., Milwaukee
Knight Mchy. Co., W. B., St. Louis
LeBlond Mach. Tool Co., Cincinnati
Niles Tool Works Co., N. Y.
Potter & Johnston Mch. Co., Pawtucket
Reed-Prentice Co., Worcester
Rockford (Ill.) Milling Machine Co.
Van Norman Mach Tool Co., Springfield, Mass.

Milling Machines, Worm
Pratt & Whitney Co., Hartford, Conn.
Waltham (Mass.) Mch. Works

Milling Tools, Adjustable Hollow
Geometric Tool Co., New Haven

Motors, Electric
Burke Electric Co., Erie
General Electric Co., Schenectady
Lincoln Electric Co., Cleveland
Master Electric Co., Dayton, O.
Ohio Electric & Controller Co., Cleveland
Reliance Elec. & Eng. Co., Cleveland
Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.
Wisconsin Electric Co., Racine

Numbering Machines
Noble & Westbrook Mfg. Co., Hartford

Nut Facing Machines
Landis Mach. Co., Waynesboro

Nut Tappers (See Bolt and Nut Machinery)

Nuts, Lock (See Lock-Nuts)

Oil and Grease Cups
Bay State Stamping Co., Worcester
Gits Bros. Mfg. Co., Chicago
Tucker, W. A. & C. F., Hartford

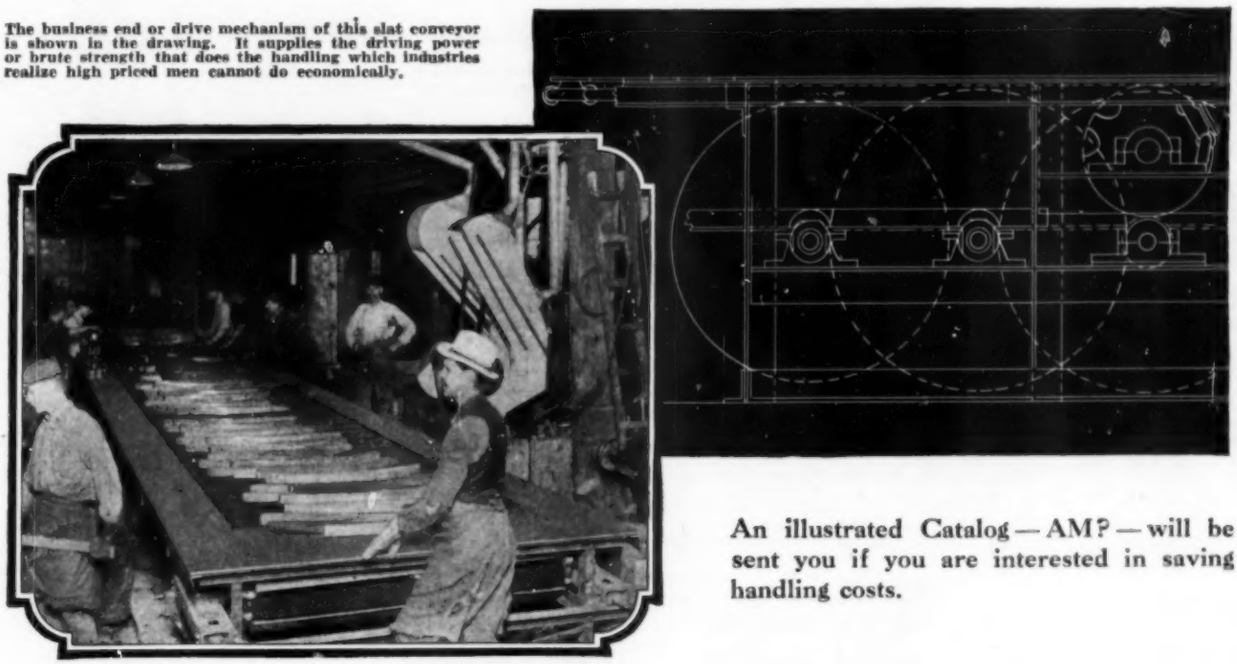
A Standard Slat Conveyor Made In North St. Paul Assists In The Making of Penn Springs

In Baldwinsville, New York, The Pennsylvania Spring Works employs skilled labor and expert mechanics. Exacting tests are used to determine the quality of steel and materials used in their products.

That their skilled workmen may accomplish all that they are capable of, and thus justify liberal wages; that their materials may remain high in quality, it is necessary that the cost of assembling of which handling is the greater part, be kept at a minimum.

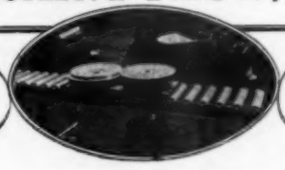
A standard assembly slat conveyor is shown in the picture to the left. It moves slowly, but steadily, to and past each workman who plays a part in the assembly picture. The result is that each man does his bit without walking, reaching, lifting, pushing, shoving or other non-essential effort. *He builds Penn Springs.*

The business end or drive mechanism of this slat conveyor is shown in the drawing. It supplies the driving power or brute strength that does the handling which industries realize high priced men cannot do economically.



An illustrated Catalog — AM? — will be sent you if you are interested in saving handling costs.

STANDARD
CONVEYOR COMPANY, NORTH SAINT PAUL, MINN.



New York, 405 Lexington Avenue
Chicago, 549 West Washington Street
Philadelphia, 3110 Market Street
Cleveland, 1108 Hippodrome Building
Indianapolis, 404 Lombard Building

Kansas City, 419 Manufacturers' Exchange Building
Milwaukee, 209 Grand Avenue
Los Angeles, 502 Grosse Building
Seattle, 1105 Second Avenue
Charlotte, P. O. Box No. 131

Cable Address: Gravity

Oil Stones
Norton Co., Worcester

Oils (See Lubricants)

Packing, Hydraulic
Graton & &Knight Mfg. Co., Worcester, Mass.

Parallels
Starrett Co., L. S., Athol, Mass.

Pattern Shop Machinery (See Woodwork Machinery)

Patterns, Wood and Metal
Mehl Mch. T. & Die Co., Roselle, N. J.

Pins, Leader
Danly Machine Specialties, Inc., Chicago

Pipe Bending Machines
Underwood Corp., H. B., Phila.

Pipe Cutting and Threading Machines
Bignall & Keeler Machine Wks., Edwardsville
Greenfield (Mass.) Tap & Die Corp.
Niles Tool Works Co., N. Y.
Ryerson & Son., Jos. T., Chicago
Saunders Sons, D., Yonkers

Pipe Fitters Tools
Butterfield & Co., Derby Line, Vt.
Cleveland (O.) Twist Drill Co.
Greenfield (Mass.) Tap & Die Corp.

Piston Ring Machines
National Acme Co., Windsor, Vt.
Potter & Johnston Mch. Co., Pawtucket

Planers, Crank
Cincinnati (O.) Gear Cutting Mch. Co.
Cincinnati (O.) Shaper Co.

Planing Machines
American Tool Wks Co., Cincinnati
Cincinnati (O.) Planer Co.
Cleveland (O.) Planer Co.
Cons. Mach. Tool Corp., Rochester
Gra. Co., G. A., Cincinnati.
Liberty Mch. Tool Co., Hamilton, O
Niles Tool Works Co., N. Y.
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia

Planing Machines, Rotary
Liberty Mch. Tool Co., Hamilton, O
Underwood Corp., H. B., Phila.

Plating, Chronium
Chronium Products Corp., N. Y.

Pneumatic Tools
Anderson Bros. Mfg. Co., Rockford
Buckeye Portable Tool Co., Dayton

Polishing and Buffing Machines
Blanchard Mch. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Bryant Chucking Grinder Co., Springfield, Vt.
Diamond Mch. Co., Providence
Greenfield (Mass.) Tap & Die Corp.
Heald Mch. Co., Worcester
Landis Tool Co., Waynesboro
Rowbottom Machine Co., Waterbury
Safety Emery Wheel Co., Springfield, O.
Union Twist Drill Co., Athol, Mass
Van Norman Mach. Tool Co., Springfield, Mass.
Wisconsin Electric Co., Racine

Post Boxes
Standard Pressed Steel Co., Phila.

Press Accessories, Punch
Danly Machine Specialties, Inc., Chicago

Pressed Steel Parts
Standard Pressed Steel Co., Phila.

Press Feeds
Littell Mach. Co., F. J., Chicago

Presses, Arbor
Crane Puller Co., So. Deerfield, Mass.
Nicholson & Co., W. H., Wilkes-Barre

Presses, Drop and Forging
Bliss Co., E. W., Brooklyn
Niagara Machine & Tool Wks., Buffalo
Toledo (O.) Mch. & Tool Co.

Presses, Foot and Hand
Adriance Mach. Wks., Inc., Brooklyn
Bliss Co., E. W., Brooklyn
Niagara Mach. & Tool Wks., Buffalo
Taylor & Fenn Co., Hartford

Presses, Forcing
Elmes Eng. Wks., Chas. F., Chicago
Lucas Machine Tool Co, Cleveland

Presses, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Oilgear Co., Milwaukee
Watson-Stillman Co., N. Y.

Presses, Power
Adriance Mch. Wks., Brooklyn
Bliss Co., E. W., Brooklyn
Cleveland (Ohio) Punch & Shear Works Co.
Fox Mach. Co., Jackson, Mich.
Lashbough-Jordan Tool & Mach. Co., Elkhart, Ind.
Niagara Mach. & Tool Wks., Buffalo
Rowbottom Machine Co., Waterbury
Toledo (O.) Mch. & Tool Co.
V & O Press Co., Hudson, N. Y.

Presses, Screw
Bliss Co., E. W., Brooklyn

Profiling Machines
Pratt & Whitney Co., Hartford, Conn.
Stark Tool Co., Waltham

Pullers, Wheel
Crane Puller Co., So. Deerfield, Mass.
Pulley Turning and Boring Machines
American Tool Wks. Co. Cincinnati.

Pulleys, Metal
American Pulley Co., Philadelphia
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
Johnson Mach. Co., Carlyle, Manchester, Conn.
Jones Fdry. & Machine Co., W. A., Chicago

Pumps, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Oilgear Co., Milwaukee

Pumps, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence
Fulflo Specialties Co., Blanchester, O.

Pumps, Power
Sullivan Mchy. Co., Chicago

Punches, Center
Brown & Sharpe Mfg. Co., Providence
Cleveland (Ohio) Punch & Shear Works Co.
Starrett Co., L. S., Athol, Mass.

Punches & Dies
Cleveland (Ohio) Punch & Shear Works Co.
Pratt & Whitney Co., Hartford, Conn.

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago

Punches, Power
Buffalo (N. Y.) Forge Co.
Mitts & Merrill, Saginaw
Niagara Mch. & T. Wks., Buffalo
Ryerson & Son, Joseph T., Chicago
Watson-Stillman Co., N. Y.

Punching and Shearing Machines
Cons. Mach. Tool Corp., Rochester
Wickes Bros., Saginaw, Mich.

Pyrometers, Electric
Bristol Co., Waterbury

Rack Cutting Machines
Newark (N. J.) Gear Cutting Mch. Co.

Racks, Cut
Boston Gear Wks. Sales Co., Quincy, Mass.
Foote Bros. Gear & Mach. Co., Chicago
Grant Gear Wks., Inc., Boston
Meisel Press Mfg. Co., Boston

Racks, Storage (See Furniture, Machine Shop)

Rammers, Foundry
Brown & Sharpe Mfg. Co., Providence

Reamer Holders
Landis Mach. Co., Waynesboro
McCrosky Tool Corp., Meadville, Pa.
Nicholson & Co., W. H., Wilkes-Barre

Reamers, Adjustable
Brubaker & Bros. Co., W. L., N. Y
Clark Equipment Co., Buchanan, Mich.
Cleveland (O.) Twist Drill Co.
Davis Boring Tool Co., St. Louis
Gisholt Mach. Co., Madison, Wis.
Greenfield (Mass.) Tap & Die Corp.
McCrosky Tool Corp., Meadville, Pa.
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford, Conn.
Taft-Peirce Mfg. Co., Woonsocket

Reamers, Die Cast
Conradson Tool Corp., Detroit

Reamers, Expanding
Davis Boring Tool Co., St. Louis

Reamers, Solid
Brubaker & Bros. Co., W. L., N. Y.
Buckeye Twist Drill Co., Alliance
Butterfield & Co., Derby Line, Vt.
Clark Equipment Co., Buchanan, Mich.
Cleveland (O.) Twist Drill Co.
Conn.
Gammons-Holman Co., Manchester, Conn.
Greenfield (Mass.) Tap & Die Corp.
Hjorth Lathe & Tool Co., Boston
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford, Conn.
Reed Mfg. Co., Erie
Union Twist Drill Co., Athol, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence
Clark Equipment Co., Buchanan, Mich.
Gammons-Holman Co., Manchester, Conn.
Greenfield (Mass.) Tap & Die Corp.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

Recorders, Pressure
Bristol Co., Waterbury
Taylor Instrument Co.'s, Rochester, N. Y.

Recorders, Temperature
Bristol Co., Waterbury

Regulators, Temperature
Taylor Instrument Co.'s, Rochester, N. Y.

Rheostats
General Electric Co., Schenectady

Rivet Sets
Hunter Saw & Mch. Co., Pittsburgh

Rivet Making Machinery
National Machinery Co., Tiffin

Riveting Machines
Grant Mfg. & Machine Co., Bridgeport
Ryerson & Son, Jos. T., Chicago

Rivets, Special Shapes
Hartford (Conn.) Ball & Rivet Co.

Rod Cutters
Tucker, W. A. & C. F., Hartford

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Rust Preventives
Oakley Chemical Co., N. Y.

Saw Frames and Blades
American Saw & Mfg. Co., Springfield, Mass.
Independent Pneu. Tool Co., Chicago
Starrett Co., L. S., Athol, Mass.
Thompson & Son Co., Henry G., New Haven, Conn.

Saw Sharpening Machines
Hunter Saw & Mch. Co., Pittsburgh

Saw Tables, Universal
Silver Mfg. Co., Salem, Ohio

Sawing Machines, Metal
Armstrong-Blum Mfg. Co., Chicago
Earle Gear & Mach. Co., Phila.
Greenfield (Mass.) Tap & Die Corp.
Peerless Machine Co., Racine
Stockbridge Machine Co., Worcester
Thompson & Son Co., Henry G., New Haven, Conn.

Sawing Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Peerless Machine Co., Racine

Saws, Band
Thompson & Son Co., Henry G., New Haven, Conn.

Saws, High Speed Friction
Ryerson & Son, Jos. T., Chicago

Saws, Metal Cutting
American Saw & Mfg. Co., Springfield, Mass.
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Hunter Saw & Mach. Co., Pittsburgh
Silver Mfg. Co., Salem
Union Twist Drill Co., Athol, Mass.

Saws, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Saws, Screw Slotting
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Union Twist Drill Co., Athol, Mass.

Scales
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Scraping Machs., Metal
Anderson Bros. Mfg. Co., Rockford

Screw Driving Machinery
Reynolds Machine Co., Massillon, O.

Screw-Machine Work
Eastern Mch. Screw Corp., New Haven
Liberty Tool & Gage Works, Woonsocket, R. I.
Link-Belt Co., Chicago
National Acme Co., Cleveland
Standard Pressed Steel Co., Phila.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cone Auto. Mch. Co., Windsor, Vt.
National Acme Co., Cleveland

Screw Machines, Plain or Hand
Acme Mch. Tool Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence
Drees Mch. Tool Co., Cincinnati
Gisholt Machine Co., Madison, Wis.
Greenfield (Mass.) Tap & Die Corp.
Jones & Lamson Mch. Co., Springfield, Vt
Pratt & Whitney Co., Hartford, Conn.

Screw Plates
Brubaker & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line, Vt.
Carpenter Tap & Die Co., J. M., Pawtucket
Greenfield (Mass.) Tap & Die Corp.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.

Screws, Cap and Set
Allen Mfg. Co., Hartford
Bristol Co., Waterbury
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland
Standard Pressed Steel Co., Phila.

Screws, Machine
Allen Mfg. Co., Hartford
Bristol Co., Waterbury
Eastern Mch. Screw Corp., New Haven

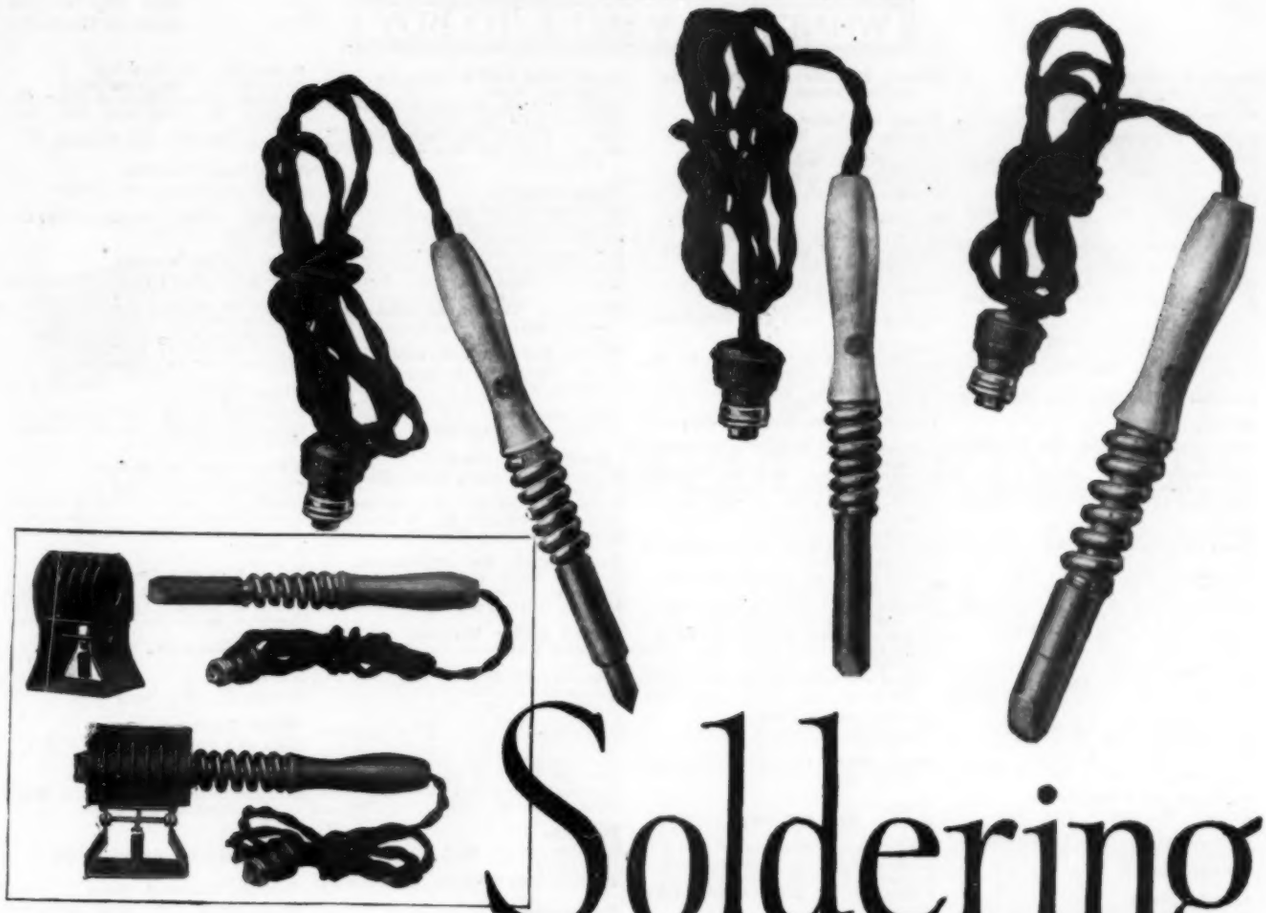
Screws, Safety Set (see Screws, Cap and Set)

Seamless Steel Tubing (See Tubing, Seamless Steel)

Second-Hand Machinery (See Searchlight Section)
Adams Co., Ogden J., Rochester
Allen Co., Inc., H. F., N. Y.
Atherton, Jesse, Providence, R. I.
Botwinik Bros., New Haven, Conn.
Brownell Mach. Co., Providence
Clarkson, D. R., Rochester, N. Y.
Delta Equip. Co., Phila.
Duff Machinery Corp., N. Y.
Eddy Machy. Co., E. A., Providence
Essley Mchy. Co., E. L., Chicago
Hill, Clark & Co., Inc., Boston
Hill, Clarke & Co., Chicago.
Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainville, Conn.
International Machy. Co., Detroit
Lamberg & Co., A., N. Y.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Marshall-Huschart Machy. Co., Chicago
Miles Mchy. Co., Saginaw
Morey & Co., N. Y.
Moyer, J. N., Phila.
Nahan Tool & Supply Co., N. Y.
Niles & Co., F. H., Jersey City, N. J
Niles-Bement-Pond Co., N. Y.
Niles Tool Works Co., N. Y.
Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Riverside Machy. Depot, Detroit
Ryerson & Son, Jos. T., Chicago
Simmons Mach Tool Corp., Albany
Strong, Carlisle & Hammond Co., Cleveland
Wickes Machy. Co., Jersey City, N. J

Separators, Oil and Waste
Barrett, Leon J., Worcester

Shafting
Hawkridge Bros., Boston
Strand & Co., N. A., Chicago



Soldering

General Electric announces to industry the introduction of five new electric soldering irons whose range of capacity varies from the lightest to the heaviest of work. Examine them!

An improved cartridge type heating unit enclosed in a heavy nickel silver case.

This casing threaded into a massive tip of high quality copper —thus insuring intimate thermal contact.

A non-conductive coil which disseminates any heat threatening to reach the handle.

A sturdy wooden handle perfectly fitting the hand.

Bolts, screws, and nuts—so easy to lose and so hard to replace —are entirely absent.

These are some of the improvements in the new G-E Soldering Irons which give to them a simplicity, efficiency, and economy of operation that is unexcelled by anything on the market.

Although electric heat will not supplant all other forms of heat for industrial purposes, there are processes in every industry where it is the ideal heat—the most economical heat—the heat that ultimately will be used.

ULTIMATELY
ELECTRIC HEAT
IN EVERY INDUSTRY

570-6

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL PRINCIPAL CITIES

Shafts, Flexible
Haskins Co., R. G., Chicago
Strand & Co., N. A., Chicago

Shaping Machines
American Tool Wks. Co., Cincinnati
Cincinnati (O.) Gear Cutting Mach. Co.
Cincinnati (O.) Shaper Co.
Hendey Mach. Co., Torrington, Conn.
Kelly Co., R. A., Xenia, Ohio
Morton Mfg. Co., Muskegon Hgts., Mich.
Niles Tool Works Co., N. Y.
Ohio Mach. Tool Co., Kenton
Potter & Johnston Mch. Co., Pawtucket.
Reed-Prentice Co., Worcester
Smith & Mills Co., Cincinnati
Springfield (O.) Mach. Tool Co.
Steel Products Eng. Co., Springfield, O.
Stockbridge Machine Co., Worcester

Shears, Hand
Armstrong-Blum Mfg. Co., Chicago

Shears, Power
Adriance Mach. Wks., Brooklyn
Birdsboro (Pa.) Steel Fdry. & Mach. Co.
Buffalo (N. Y.) Forge Co.
Mitts & Merrill, Saginaw
Niagara Mch. & T. Wks., Buffalo
Ryerson & Son, Jos. T., Chicago
Landis Mch. Co., Waynesboro.
Murchey Mach. & Tool Co., Detroit
Toledo (O.) Mch. & Tool Co.
Tucker, W. A. & C. F., Hartford
Unishear Co., N. Y.

Sheet Metal Work
Dickgiesser & Co., Chas. J., Derby, Conn.

Sheet Metal Working Machinery
Adriance Mach. Wks., Brooklyn
Bliss Co., E. W., Brooklyn
Cincinnati (O.) Gear Cutting Mach. Co.
Cincinnati (O.) Shaper Co.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Jos. T., Chicago
Toledo (O.) Mch. & Tool Co.
Unishear Co., N. Y.

Shelving, Steel
Manufacturing Equipment & Engr. Co., Framingham, Mass.

Slotting Machines
Cons. Mach. Tool Corp., Rochester
National Acme Co., Cleveland
Niles Tool Works Co., N. Y.
Sellers & Co., Wm., Philadelphia

Sockets and Sleeves
Cleveland (O.) Twist Drill Co.

Speed Reducer
Albaugh-Dover Mfg. Co., Chicago
Boston Gear Wks. Sales Co., Norfolk Downs
Cleveland (O.) Worm & Gear Co.
Foote Bros. Gear & Mach. Co., Chicago
Grant Gear Wks., Inc., Boston
Jones Fdry. & Machine Co., W. A., Chicago
Philadelphia (Pa.) Gear Works
Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.

Spindles
Ex-Cell-O Tool & Mfg. Co., Detroit

Spring Winders
Hjorth Lathe & Tool Co., Boston

Sprockets and Chains
Bilgram Mch. Wks. Sales Co., Philadelphia
Boston Gear Wks. Sales Co., Norfolk Downs
Cullman Wheel Co., Chicago.
Grant Gear Wks., Boston.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Morse Chain Co., Ithaca, N. Y.
Philadelphia (Pa.) Gear Works
Ramsey Chain Co., Albany
Whitney Mfg. Co., Hartford

Squares
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Stampings, Metal
American Pulley Co., Philadelphia
Atlas Mfg. Co., New Haven, Conn.
Bay State Stamping Co., Worcester
Detroit (Mich.) Stamping Co.
Liberty Tool & Gage Works, Woonsocket, R. I.
Lashbough-Jordan Tool & Mach. Co., Elkhart, Ind.
Rockwood Sprinkler Co., Worcester

Stamps, Steel
Hoggson & Peters Mfg. Co., New Haven
Noble & Westbrook Mfg. Co., Hartford

Stands, Portable (See Furniture, Machine Shop)

Steam Specialties
Dart Mfg. Co., E. M., Providence

Steel, Cold Rolled Strip
Carpenter Steel Co., Reading
Hawkridge Bros. Co., Boston

Steel Crucible
Carpenter Steel Co., Reading
Columbia Tool Steel Co., Chicago Heights

Steel, Rustless and Stainless
Carpenter Steel Co., Reading
Firth-Sterling Steel Co., McKeesport

Steel, Sheet
Crucible Steel Co. of Amer., N. Y.
Hawkridge Bros. Co., Boston
Jessop Steel Co., Washington, Pa.
Jessop & Sons, Wm., N. Y.
Ryerson & Son, Jos. T., Chicago

Steels, Alloy, Carbon and High Speed
Armstrong Bros. Tool Co., Chicago
Carpenter Steel Co., Reading
Cleveland (O.) Twist Drill Co.
Columbia Tool Steel Co., Chicago Heights
Firth-Sterling Steel Co., McKeesport
Hawkridge Bros., Boston
Jessop Steel Co., Washington, Pa.
Jessop & Sons, Wm., N. Y.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Ryerson & Son, Jos. T., Chicago
Vanadium Alloys Steel Co., Pittsburgh
Vulcan Crucible Steel Co., Aliquippa, Pa.

Straightening Machinery
Springfield (O.) Mach. Tool Co.

Stools, Shop (See Furniture, Machine Shop)

Stringers
Midwest Steel & Supply Co., N. Y.

Stud Setters, Self-Opening
Atwood Mfg. Co., Anderson, Ind.
Geometric Tool Co., New Haven
McCrosky Tool Corp., Meadville, Pa.

Subpresses and Dies
U. S. Tool Co., Ampere, N. J.
Waltham (Mass.) Mach. Works

Swaging Machines
Etna Machine Co., Toledo
Langelier Mfg. Co., Cranston, R. I.
Torrington (Conn.) Co.

Switches and Switchboards
General Electric Co., Schenectady
Hart & Hegeman Mfg. Co., Hartford

Tachometers
Bristol Co., Waterbury

Tap Extensions
Allen Mfg. Co., Hartford

Tap Holders
Buhr Mach. Tool Co., Ann Arbor, Mich.
Errington Mech. Laboratory, N. Y.
Greenfield (Mass.) Tap & Die Corp.
McCrosky Tool Corp., Meadville, Pa.

Taper Pins
Pratt & Whitney Co., Hartford, Conn.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Acme Mchy. Co., Cleveland.
American Tool Wks. Co., Cincinnati
Ames Co., B. C., Waltham
Baker Bros., Toledo
Barber-Colman Co., Rockford
Barnes Drill Co., Inc., Rockford
Buhr Mach. Tool Co., Ann Arbor,
Cincinnati (O.) Bickford Tool Co.
Errington Mech. Laboratory, N. Y.
Mich.
Fox Mch. Co., Jackson, Mich.
Geometric Tool Co., New Haven
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Cranston, R. I.
McCrosky Tool Corp., Meadville, Pa.
Moline (Ill.) Tool Co.
Murchey Mach. & Tool Co., Detroit
Nat'l Automatic T. Co., Richmond, Ind.
National Mchy. Co., Tiffin.
Sloan & Chase, Inc., Newark, N. J.
Wahlstrom Tool Co., Brooklyn
Whitney Mfg. Co., Hartford

Taps and Dies
Brubaker & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line, Vt.
Carpenter Tap & Die Co., J. M., Pawtucket
Greenfield (Mass.) Tap & Die Corp.
Landis Mach. Co., Waynesboro
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Murchey Mach. & Tool Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford, Conn.
Oxweld Acetylene Co., Long Island City, N. Y.

Taps, Collapsing
Cons. Mach. Tool Corp., Rochester
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Landis Mach. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland

Tempering Compounds (See Case Hardening, etc.)

Testing Apparatus, Hardness
Shore Instrument & Mfg. Co., Jamaica, N. Y.

Thermometers
Bristol Co., Waterbury

Thread-Cutting Tools
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Greenfield (Mass.) Tap & Die Corp.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
Pratt & Whitney Co., Hartford, Conn.

Thread Rolling Machines
National Machinery Co., Tiffin

Threading Machines
Automatic Machine Co., Bridgeport
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Grant Mfg. & Mch. Co., Bridgeport
Greenfield (Mass.) Tap & Die Corp.
Hall Planetary Co., Philadelphia
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Mchy. Co., Tiffin

Tool Bits
Columbia Tool Steel Co., Chicago Heights
Firth-Sterling Steel Co., McKeesport

Tool Cases
Waterston, J. M., Detroit

Tool Holders
Armstrong Bros. Tool Co., Chicago
O. K. Tool Co., Shelton, Conn.

Tool Posts, Lathe
Armstrong Bros. Tool Co., Chicago
O. K. Tool Co., Shelton, Conn.

Tool Work (See Contract Work)

Tools, Small (See Machinists' Small Tools)

Tractors and Trucks, Industrial
Elwell Parker Elect. Co., Cleveland

Transformers
General Electric Co., Schenectady

Transmission Machinery
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Moore & White Co., Philadelphia
Morse Chain Co., Milwaukee
Oilgear Co., Milwaukee
Standard Pressed Steel Co., Phila.
Whitney Mfg. Co., Hartford

Transportation System (See Trucks)

Trap Extractors, Broken
Walton Co., Hartford, Conn.

Trolleys & Tramways
Nuttall Co., R. D., Pittsburgh
Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.

Trucks, Hand Power and Lift
Marion (Ind.) Tool Works

Turbines, Steam
General Electric Co., Schenectady

Turret Machines (See Lathes, Horizontal Turret)

Turrets, Tool Post
American Tool Wks. Co., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Unions, Pipe
Dart Mfg. Co., E. M., Providence

Valves, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Vises, Drilling Machine
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford
Brown Eng. Co., Reading
Graham Mfg. Co., Providence
Hartford (Conn.) Special Mchy. Co.
Hoggson & Pettis Mfg. Co., New Haven
Thomas Elevator Co., Chicago

Vises, Metal Workers'
Fulton Drop Forge Co., Canal Fulton
Hartford (Conn.) Special Mchy. Co.
Reed Mfg. Co., Erie.

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mch. Co.
Greenfield (Mass.) Tap & Die Corp.
Hartford (Conn.) Special Mchy. Co.
Kempsmith Mfg. Co., Milwaukee
Reed-Prentice Co., Worcester
Whitney Mfg Co., Hartford

Vises, Pipe
Butterfield & Co., Derby Line, Vt.
Greenfield (Mass.) Tap & Die Corp.
Reed Mfg. Co., Erie

Vises, Planer and Shaper
Cincinnati (O.) Planer Co.
Hartford (Conn.) Special Mchy. Co.
Hendey Mach. Co., Torrington, Conn.
Hoggson & Pettis Mfg. Co., New Haven

Vises, Universal Machine
Brown & Sharpe Mfg. Co., Providence
Hartford (Conn.) Special Mchy. Co.
Hoggson & Pettis Mfg. Co., New Haven
Skinner Chuck Co., New Britain

Voltmeters
Bristol Co., Waterbury

Wagon Loaders
Link-Belt Co., Chicago

Wash Stands & Bowls
Manufacturing Equipment & Engr. Co., Framingham, Mass.

Washers
Detroit (Mich.) Stamping Co.

Washing Machines, Metal
Colts Patent Fire Arms Mfg. Co., Hartford

Welding Machines, Electric
Acme Electric Welder Co., Los Angeles
Federal Mch. & Weld. Co., Warren
General Electric Co., Schenectady
Lincoln Electric Co., Cleveland
Taylor Welder Co., Warren
Thomson Elec. Welding Co., Lynn

Welding Machines, Oxyacetylene
Imperial Brass Mfg. Co., Chicago
Oxweld Acetylene Co., Long Island City, N. Y.
Weldit Acetylene Co., Detroit

Welding Supplies
Oxweld Acetylene Co., Long Island City, N. Y.
Taylor Welder Co., Warren
Weldit Acetylene Co., Detroit

Wire
Hawkridge Bros. Co., Boston
Phosphor Bronze Smelting Co., Phila.

Wire and Cable
Simplex Wire & Cable Co., Boston

Woodruff Keys
Whitney Mfg. Co., Hartford

Wood Screw Machinery
Cook, Asa. S., Hartford

Wood Working Machinery
Porter Cable Mach. Co., Syracuse, N. Y.
Seneca Falls (N. Y.) Machine Co.
Silver Mfg. Co., Salem, Ohio

Worm Drives
Albaugh-Dover Mfg. Co., Chicago
Cleveland (O.) Worm & Gear Co.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago

Wrenches, Pipe
Greenfield (Mass.) Tap & Die Corp.

Wrenches, Ratchet
Starrett Co., L. S., Athol, Mass.

Wrenches, Tap
Butterfield & Co., Derby Line, Vt.
Greenfield (Mass.) Tap & Die Corp.
Starrett Co., L. S., Athol, Mass.

MIDWEST

STEEL STRINGERS

FOR SUPPORTING OF OVERHEAD EQUIPMENT

You Can

Change your overhead power transmission layout in any direction and at any time when your production expands. Only a bolt wrench is required to install this equipment.

Send for Our Circular A-100

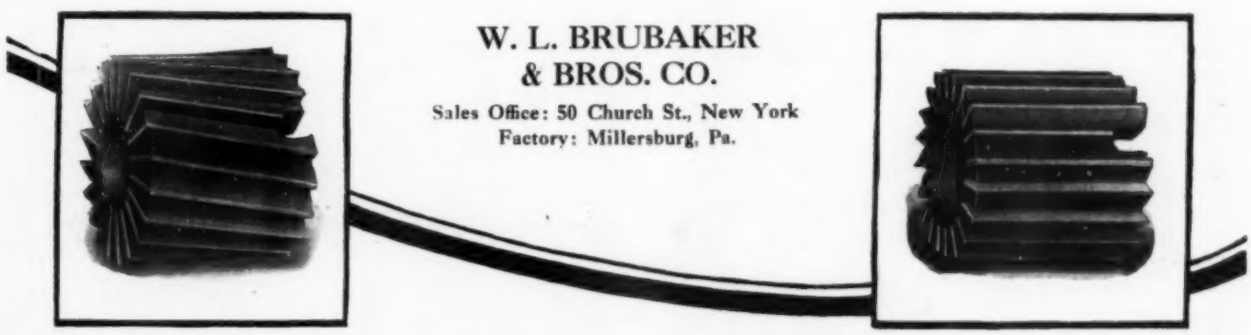
MIDWEST STEEL & SUPPLY CO., Inc.
BRADFORD, PA., U. S. A.

They never ride the job—they go thru it

Like a warm knife thru butter—that's the impression a Brubaker Shell End Mill gives you as it tackles its job.

The rake of the teeth, the keenness of their cutting edges and the proper degree of temper throughout are the causes for such performance.

Your most powerful millers fitted with Brubaker Mills give you equipment that produces with profit.



W. L. BRUBAKER & BROS. CO.
Sales Office: 50 Church St., New York
Factory: Millersburg, Pa.

ALPHABETICAL INDEX TO ADVERTISEMENTS

	Page
Abbott Ball Co	90
Abrasive Machine Tool Co	82
Acme Electric Welder Co	61
Acme Industrial Co	73
Acme Machine Tool Co	36
Acme Machinery Co	81
Adams Co	66
Adams Co., Inc., Ogden R	107
Adriance Machine Works, Inc	88
Albaugh Dover Mfg. Co	66
Allen Co, H. F	104
Allen Mfg. Co	87
Aluminum Co. of America	100
American Engineering Co	72
American Fdry. Equip. Co	76
American Gas Furnace Co	60
American Hollow Boring Co	58
American Pulley Co	72
American Saw & Mfg. Co	81
American Shipbuilding	108
American Swiss File & Tool Co	27
American Tool Works Co	12, 13
Ames Co., B. C	86, 91
Anderson Bros. Mfg. Co	74
Armstrong-Blum Mfg. Co	81
Armstrong Bros. Tool Co	96
Arter Grinding Machine Co	83
Atlas Mfg. Co	111
Atwood Mfg. Equipment Co	92
Auburn Ball Bearing Co	74
Automatic Machine Co	78
Badger Tool Co	83
Baker Bros	85
Barber Colman Co	68, 94
Bardons & Oliver	86
Barnes Drill Co	84
Barrett, Leon J	98
Bay State Stamping Co	98
Bearings Co. of America	74
Besly & Co., Chas. H	82
Bethel-Player Co	87
Bignall & Keeler Machine Works	80
Bilgram Machine Works	67
Blanchard Machine Co	82
Bliss Co., E. W	89
Boston Gear Works	67
Boston Scale & Machine Co	91
Botwinik Bros	105, 107
Bradford Machine Tool Co	86
Bradley & Son, C. C	88
Bristol Co	72
Brock, Jr., Tool & Mfg. Works, Arthur	111
Brown Co., A. & F	68
Brownell Mchy. Co	108
Brown Engineering Co	72
Brown & Sharpe Mfg. Co	50, 51
Brubaker & Bros. Co. W. I	123
Bryant Chucking Grinder Co	82
Buckeye Twist Drill Co	96
Buffalo Forge Co	76
Buhr Machine Tool Co	85
Bullard Machine Tool Co	16, 17
Bunting Brass & Bronze Co	60
Burke Electric Co	77
Butterfield & Co. Division Union Twist Drill Co	38
Caldwell Son, H. W	74
Carborundum Co	115
Card Mfg. Co. S. W	46
Carlton Machine Tool Co	85
Carpenter Steel Co	58
Carpenter Tap & Die Co., J. M	94
Carroll Jamieson Mach. Tool Co	86
Casler, Herman	92
Chowning Regulator Corp	111
Chromium Products Corp	63
Cincinnati Bickford Tool Co	8, 9
Cincinnati Gear Co	67
Cincinnati Gear Cutting Machine Co	68
Cincinnati Milling Machine Co	6, 7
Cincinnati Planer Co	42
Clark Equipment Co	76
Clark, Jr., Electric Co., Jas	77
Clarkson, D. R	109
Cleveland Planer Co	79
Cleveland Twist Drill Co	96
Cleveland Worm Gear Co	66
Cochrane Bly. Co	81
Cold Finished Steel Bar Industry Insert betwe n	92, 93
Colts Patent Fire Arms Mfg. Co	88
Columbia Tool Steel Company	60
Columbus Die, Tool & Mach. Co	110
Cone Automatic Machine Co	81
Conradson Tool Corp	93
Cons. Mch. Tool Corp. of Am	23
Contract Work	110
Cook Co., Asa S	80
Crane Puller Co	70
Cross Gear Tooth & Rounder Co	106
Cullman Wheel Co	72
Cushman Chuck Co	92
Dalton Tool Corp	117
Danly Machine Specialties, Inc	38
Dart Mfg. Co., E. M	84
Davis Boring Tool Co	99
Davis Keyseater Co	94
Delta Equipment Co	106
Desmond Stephan Mfg. Co	83
Detroit Stamping Co	78
Diamond Machine Co	83
Dickinson, Thomas L	48
Diefendorf Gear Corp	66
Dreses Machine Tool	84
Duff Machy. Corp	104
Durant Mfg. Co	91
Earle Gear & Machine Co	66
Eastern Machine Screw Corp	90
Eddy Co., Inc., E. A	104
Elmes Eng. Works, Chas. F	88
Elwell-Parker Electric Co	48
Errington Mechanical Laboratory	85
Essley Mchy. Co., E. L	109
Etna Machine Co	76
Evans Friction Cone Co	72
Ex-Cell-O Tool & Mfg Co	72
Fafnir Bearing Co	74
Fawcus Machine Co	67
Federal Machine & Welder Co	61
Federal Products Corp	91
Fellows Gear Shaper Co	14, 15
Firth Sterling Steel Co	63
Fitchburg Grinding Machine Co	82
Flather Co	80
Foote-Burt Co	85
Foote Bros. Gear & Machine Co	67
Ford Chain Block Co	70
Fox Machine Co	70
Franklin Die-Casting Corp	60
Franklin Machine Co	110
Frank Trucking & Rigging Co	106
Fulton Drop Forge Co	73
Gallmeyer & Livingston Co	83
Gammons-Holman Co	96
Ganschow Co., Wm	66
General Die Castings Co	60
General Electric Co	62, 121
Geometric Tool Co	96
Gisholt Machine Co	34, 35
Gits Bros. Mfg. Co	98
Gleason Works	64
Gorton Machine Co., Geo	74
Goss & de Leeuw Mach. Co	79
Graham Mfg. Co	73, 82
Grant Gear Works	66
Grant Mfg. & Machine Co	76
Graton & Knight Mfg. Co	Front Cover
Gray Co., G. A	39
Gray & Prior Machine Co	98
Grease-ometer Corp	73
Greaves-Klusman Tool Co	87
Greenfield Tap & Die Corp	31
Hall Planetary Co	80
Hanson Whitney Mach. Co	37
Hardinge Bros	89
Hart & Co., Inc., Frederick	111
Hart & Hegeman Mfg. Co	77
Hartford Ball & Rivet Co	74
Hartford Special Machinery Co	110
Hart Mfg. Co., R. E	91
Haskins, R. G	72
Hawkridge Bros. Co	58
Heald Machine Co	22
Hendey Machine Co	33
Hill, Clarke & Co., Inc	106
Hill, Clarke & Co., of Chicago	102
Hjorth Lathe & Tool Co	88
Hoefer Mfg. Co	84
Hogeson & Pettis Mfg. Co	92
Horsburgh & Scott Co	66
Hunter Saw & Machine Co	81
Hyman & Sons, Joseph	106, 108
Ideal Machy. Co	106
Imperial Brass Mfg. Co	61
Ingersoll Milling Machine Co	18
International Machinery Co	106
International Machine Tool Co	90
Jessop & Sons Inc. Wm	60
Jessop Steel Co	58
Johnson Gas Appliance Co	61
Johnson Machine Co., Carlyle	3
Jones & Lamson Mach. Co	10, 11, 48
Jones Fdry. & Machine Co., W. A	70
Karas, S	101
Kearney & Trecker Corp	24
Kelly Co., R. A	80
Keller Mech. Engineering Co	111
Kempsmith Mfg. Co	30
Kent Owens Machine Co	99
Kingsbury Mfg. Co	85
Knight Machinery Co., W. D	80
Lakeside Steel Improvement Co	111
Lamberg & Co., A	107
Lambert & Todd Machine Co	111
Landis Machine Co	47
Landis Tool Co	32
Langelier Mfg. Co	63
Lapointe Co., J. N	55
Lapointe Machine Tool Co	80
Latrobe Electric Steel Co	58
LeBlond Mach. Tool Co., R. K.	4th Cover
Lees Bradner Co	68
Leland-Gifford Co	85
Liberty Machine Tool Co	46
Liberty Tool & Gage Works	110
Light Mfg. & Fdry. Co	60
Lincoln Electric Co	44, 45
Lincoln Machine Co	110
Link Belt Co	2nd Cover
Littell Machine Co., F. J	90
Lodge & Shipley Machine Tool Co	4, 5
Loshbrough-Jordan Tool & Mach. Co	90
Lucas & Son, Inc., J. L	108
Lucas Machine Tool Co	42
Ludlum Steel Co	63
Magnolia Metal Co	60
Marshall-Huschart Mchy. Co	107
Master Electric Co	77
McCrosky Tool Corp	92
McGraw-Hill Book Co	97
McGraw-Hill Publishing Co., Inc	56, 57
Mehl Machine Tool & Die Co	111
Meisel Press Mfg. Co	67
Merit Oil Equipment Co	85
Midwest Steel & Supply Co	123
Miles Machinery Co	109
Mitts & Merrill	87
Moline Tool Co	84
Monarch Machine Tool Co	26
Moore & White Co	72
Morey & Co., Inc	104
Morse Chain Co	71
Morse Twist Drill & Machine Co	60
Morton Mfg. Co	80
Moyer, J. N	108
Murchey Machine & Tool Co	113
Naham Tool & Supply Co	108
National Acme Co	41
National Automatic Tool Co	84
National Machinery Co	81
National Mach. Tool Builders Ass'n	2
National Tool Co	99
National Twist Drill & Tool Co	98
Neil & Smith Electric Tool Co	77
Newark Gear Cutting Machine Co	68
New Departure Mfg. Co	19
New York Machinery Co	101
New York Mchy. Co	106
Ney Co., J. M	92
Niagara Machine & Tool Works	87
Nicholson, W. H	87
Niles Bement Pond Co	109
Niles, F. H	104
Niles Tool Works Co	28, 109
Noble & Westbrook	87
Noham Tool & Supply Co	108
Norton Co	40
Nuttall Co., R. D	65
Oakley Chemical Co	98
Oesterlein Machine Co	36
Ohio Electric & Controller Co	76
Ohio Machine Tool Co	80
Oilgear Co	43
O. K. Tool Co., Inc	94
Oliver Instrument Co	91
Osborne & Sexton Machy. Co	108
Oxweld Acetylene Co	3rd Cover
Parker, C. L	101
Pawtucket Mfg. Co	95
Peerless Machine Co	81
Pennsylvania Gear & Machine Co	67
Philadelphia Gear Works	64
Phosphor Bronze Smelting Co	63
Porter Cable Machine Co	86
Positions Vacant & Wanted	100, 101
Potter & Johnston Machine Co	20, 21
Pratt & Whitney Co	29
Precision Gauge & Tool Co	90
Preis & Co., H. P	110
Prentice & Co., Henry	103
Randall & Stickney	60
Raybestos Co	72
Reading Chain & Block Corp	70
Reed Mfg. Co	73
Reed-Prentice Co	39
Reliance Electric & Engineering Co	77
Rhoads & Sons, J. E	72
Riverside Mchy. Depot	107, 109
Rivett Lathe & Grinder Corp	87
Rockford Drilling Machine Co	84
Rockwood Sprinkler Co	48
Rockford Milling Machine Co	80
Rowbottom Machine Co	78
Ryerson & Son, Jos. T	95
Safety Emery Wheel Co	117
Saunders Sons, D	73
Schmidt Inc., Geo. T	91
Schuchardt & Schutte (George Scherr)	68
Searchlight Section	111
Sellers & Co., Wm	79
Seneca Falls Machine Co	86
Shore Instrument & Mfg. Co	91
Shepard Electric Crane & Hoist Co	73
Silver Mfg. Co	84
Simmons Machine Tool Corp	118
Simonds Mfg. Co., Pittsburgh	66
Simplex Wire & Cable Co	77
Skinner Chuck Co	92
Sloan & Chase Inc	79
Smith & Davis Mfg. Co	106
Smith & Mills Co	80
Sonn Mfg. Co	60
South Bend Lathe Works	86
Special Machine Tool Engr. Wks	120
Specialty Brass Co	60
Sprague Corp	110
Springfield Machine Tool Co	86
Standard Conveyor Co	119
Standard Pressed Steel Co	72
Stark Tool Co	86
Starrett Co., L. S. The	53
Steel, Ltd., James	101
Steinle Turret Machine Co	86
Stewart Die Casting Co	60
Stockbridge Mach. Co	78
Strand & Co., N. A	77
Strom Ball Bearing Mfg. Co	74
Strong Carlisle & Hammond Co	60, 95, 109
Sullivan Machinery Co	76
Taft Peirce Mfg. Co	94
Taylor & Fenn Co	78
Taylor Instrument Co	91
Taylor Welder Co	61
Thomas Elevator Co	92
Thomson Electric Welding Co	61
Thompson Grinder Co	82, 111
Thompson, H. G	82
Threadwell Tool Co	96
Timken Roller Bearing Co	75
Toledo Machine & Tool Co	89, 100
Torrington Co	76
Tucker, Inc., W. A. & C. F	98
Underwood Corp., H. B	95
Union Electric Mfg., Co	76
Union Mfg. Co	92
Union Twist Drill Co	25
Unishear Co	113
United Amer. Metals Corp	58
U. S. Drill Head Co	84
U. S. Machine Tool Co	78
U. S. Tool Co. Inc	90
Universal Grinding Machine Co	82
V & O Press Co	90
Vanadium Alloys Steel Co	59
Van Norman Machine Tool Co	80
Vesder Mfg. Co	94
Vitrified Wheel Co	83
Vulcan Crucible Steel Co	58
Wade Tool Co	87
Wahlstrom Tool Co	92
Walker Inc., O. S	83
Waltham Machine Works	68
Walton Co	94
Wanted	100
Waterston, J. M	96
Watson-Stillman Co	76
Wayne Tool Mfg. Co	101
Weldit Acetylene Co	61
Wheel Truing Tool Co	82
Whitney Mfg. Co	49
Whiton Machine Co., D. E	48
Wickes Bros	87
Willys Morrow Co., Inc	110
Wilmarth & Morman Co	84
Wisconsin Elect. Co	82